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Long Island Basin, Westchester County, New York
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Westchester County
Silver Mine River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and the visual inspection of Browns Reservoir Dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Using the Corps of Engineers "Screening Criteria" for the initial review of spillway adequacy, it has been determined that the embankment would be overtopped for all storms in excess of 38% of the PMF (Probable Maximum Flood). The spillway is, therefore, adjudged as "seriously inadequate", and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in the spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

It is, therefore, recommended that within 3 months of notification to the owner, detailed hydrologic/hydraulic investigations of the structure be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the 1/2 PMF. The investigations should be completed within 1 year and remedial measures completed during the following year. In the interim, a detailed emergency action plan must be developed and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition the dam has a number of problem areas, which if left uncorrected, have the potential for the development of potentially hazardous conditions, and must be corrected within 1 year. These areas are:

1. Monitor the seepage at the toe of slope below the outlet works, at bi-weekly intervals with the aid of weirs. Also monitor the soft wet area below the right spillway buttress.

2. Repair the deteriorated concrete of the spillway and spillway buttresses.

3. Remove the vegetation observed on the embankments and along the downstream channels. Provide a program of periodic cutting and mowing of these surfaces.

4. Repair the minor erosion observed on the downstream slopes of the embankments near the spillway buttresses.

5. Investigate the condition of the wet well and the valves within the gate house. Repair as required to return these valves to operational status. The valves in the gate house should be used for control instead of those in the outlet chamber to reduce the internal pressures within the pipe and embankment.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of all valves. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

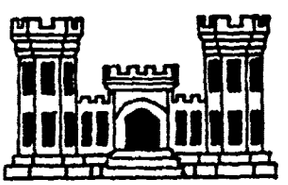
LONG ISLAND BASIN

BROWNS RESERVOIR DAM

WESTCHESTER COUNTY NEW YORK

INVENTORY NO. N.Y. 763

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



NEW YORK DISTRICT CORPS OF ENGINEERS

JULY, 1980

CONTRACT NO. DACW-51-79-C0001

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

(11) 30 Sep 81

(12) 196

(6) PHASE I INSPECTION REPORT,
NATIONAL DAM SAFETY PROGRAM.
BROWNS RESERVOIR DAM I.D. ~~No. 763~~ (Inventory Number II NY-513)
DEC #232 BE-436), LONG ISLAND BASIN,
WESTCHESTER COUNTY, NEW YORK.
Phase I Inspection Report

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(10) George Kerr

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	Browns Reservoir (I.D. No. NY 763)
State Located	New York
County Located	Westchester
Stream	Silver Mine River
Date of Inspection	July 9, 1980

ASSESSMENT

The examination of documents and the visual inspection of Browns Reservoir Dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using the Corps of Engineers "Screening Criteria" for the initial review of spillway adequacy, it has been determined that the embankment would be overtopped for all storms in excess of 38% of the PMF (Probable Maximum Flood). The spillway is, therefore, adjudged as "seriously inadequate", and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in the spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

It is, therefore, recommended that within 3 months of notification to the owner, detailed hydrologic/hydraulic investigations of the structure be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the 1/2 PMF. The investigations should be completed within 1 year and remedial measures completed during the following year. In the interim, a detailed emergency action plan must be developed and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition the dam has a number of problem areas, which if left uncorrected, have the potential for the development of potentially hazardous conditions, and must be corrected within 1 year. These areas are:

1. Monitor the seepage at the toe of slope below the outlet works, at bi-weekly intervals with the aid of weirs. Also monitor the soft wet area below the right spillway buttress.

2. Repair the deteriorated concrete of the spillway and spillway buttresses.

3. Remove the vegetation observed on the embankments and along the downstream channels. Provide a program of periodic cutting and mowing of these surfaces.

4. Repair the minor erosion observed on the downstream slopes of the embankments near the spillway buttresses.

5. Investigate the condition of the wet well and the valves within the gate house. Repair as required to return these valves to operational status. The valves in the gate house should be used for control instead of those in the outlet chamber to reduce the internal pressures within the pipe and embankment.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of all valves. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

George Koch

George Koch
Chief, Dam Safety Section
New York State Department
of Environmental Conservation
NY License No. 45937

Approved By:

Colonel W. M. Smith Jr.
New York District Engineer

Date: 30-Sep 80

Photo #1 Overview of Brown's Reservoir Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BROWNS RESERVOIR DAM I.D. No. 763
DEC #232 BE-4361 LONG ISLAND BASIN
WESTCHESTER COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to human life and property and recommend measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Browns Reservoir Dam consists of a 175.5 feet long stepped concrete spillway constructed between 2 homogeneous earth embankments (left embankment length=200 feet, right embankment length=1000 feet), the maximum height of which is 48 feet. The upstream slopes of the earth embankments are 1 vertical on 2 horizontal, the downstream slopes are 1 on 1.5, and the crest of the dam is 14 feet wide. A concrete and cyclopean core wall, located along the centerline of the embankments, extends from 1.5 feet below the crest to a variable depth. Plans indicate that the core wall is 2 feet wide at the top and slopes outward at a rate of 3/4 inches per foot on both the upstream and downstream faces. A gate house and gate chamber located near the right abutment of the right embankment contains three gate valves which control the flow through a 6 inch, 16 inch and 30 inch pipe. The 6 inch pipe provides drainage within the well. The 16 and 30 inch pipes provide discharge from the reservoir to augment the capacity of the 2 downstream reservoirs, which supply water to the City of Norwalk, Connecticut. An outlet chamber at the downstream toe of the embankment also contains valves for the 16 and 30 inch pipes. These valves are currently used to control the downstream discharge.

b. Location

The dam is located on the Silver Mine River, approximately 6 miles north of the City of Norwalk, Connecticut.

c. Size

The dam is 48 feet high and impounds approximately 890 acre-feet. The dam is classified as "intermediate" in size (40 to 100 feet in height).

d. Hazard Classification
The dam is classified as "high" hazard due to the potential for a chain reaction failure situation of the dams within the Silver Mine River Basin which are above the City of Norwalk.

e. Ownership
The dam is owned and operated by the City of Norwalk, First Water District, Mr. William Leahy, Superintendent of Filter Plant & Watershed, 3 Beldon Avenue, Norwalk, Connecticut. Telephone: (203)966-1473.

f. Purpose of the Dam
The dam provides storage for the supply of water to the City of Norwalk, Connecticut.

g. Design and Construction
The dam was designed by Charles M. Wood, and was built in 1910 by the Jabson Hacker Co., New York, N.Y. The dam was raised in 1924 from elevation 414 to its present height at elevation 420, by Frank B. Hastings, contractor, the engineer was Samuel W. Hoyt Jr. Company Inc. All available information concerning the construction and reconstruction has been included in Appendix F. The dam is composed of a concrete spillway constructed between two earth embankments, the maximum height of which is 48 feet.

h. Normal Operating Procedures
All flows in excess of the demand for water by the City of Norwalk are discharged over the spillway.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	7.56
b. Discharge at Dam (cfs)	
Spillway at Maximum High Water	3931
Reservoir Drain at Normal Water Elevation	190
c. Elevations (USGS Datum)	
Top of Dam	436.
Spillway Crest	432.
Reservoir Drain Invert	390.
d. Reservoir (acres)	
Surface Area at Top of Dam	55.
Surface Area at Crest of Dam	44.
e. Storage Capacity (acre feet)	
Top of Dam	1067
Spillway Crest	891
f. Dam	
Type: Homogeneous Earth with cyclopean concrete core wall.	
Length (ft):	1200.
Slopes upstream	2:1
downstream	1 1/2:1
Crest Width (ft):	14'

g. Spillway

Type: Stepped concrete overflow structure.

Weir Length (ft): 175.5'

h. Reservoir Drain

Type: Two concrete encased pipes 16 & 30 inches.

Control: Manual control valves at the gate and toe of the dam.

SECTION 2: ENGINEERING DATA

2.1 GEOLOGY

Browns Reservoir Dam is located in the "New England Uplands" physiographic province of New York State. Maximum relief is in the Hudson Highlands, where elevations range from 800 feet below sea level (bedrock of the Hudson River Valley) to more than 1500 feet. Rocks in these uplands are either metamorphic or igneous, and land forms are closely related to their durability. Strong topographic linearity characterizes the Hudson Highlands; most of the ridges and valleys follow the northeast-southwest strike of the metamorphosed rocks.

The "Landforms and Bedrock Geology of New York State" prepared University of the State of New York indicates that the bedrock in the vicinity of the dam is the Hartland Formation - basal amphibolite overlain by pelitic schists. (Middle Ordovician through lower Cambrian rocks initially deformed by the Taconic Orogeny (435-455 million years ago) and subsequently by the Acadian Orogeny.) The "Generalized Tectonic-Metamorphic Map of New York", compiled by Fisher, Isachsen, and Richard (1971) indicates that the tectonic unit in the vicinity of the dam is "eugeosynclinal (rise-rock)" thrust sheets, intensely deformed with carbonate slivers along faults.

The "Preliminary Brittle Structures Map of New York" developed by Isachsen and McKendree (1977), does not indicate the presence of any faulting or other brittle deformations within the vicinity of the dam or impoundment. Several topographic linear features are present to the north and west, but are a significant distance from the dam.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigation could be located for the dam. The "General Soil Map of New York State" prepared by Cornell University Agriculture Experiment Station, indicates that the surficial soils are Charlton Soils of glacial till origin. These soils are formed on unstratified variable glacial till and residuum predominantly from schists but in places including gneiss and granite. The soils are stony silt and sand with a trace of clay. In places ledgey pieces and boulders are numberous. Rock outcrops are common, but the depth to rock is extremely variable. The overall drainage and permeability is good. The soil is also considered erodible due to the limited clay content.

2.3 DAM AND APPURTENANT STRUCTURES

The dam was built in 1910 by the Jabson Hooker Co., New York, N.Y.; the engineer was Charles M. Wood. The dam was raised in 1924 to its present height by the contractor Frank B. Hastings; the engineer was Samuel W. Hoyt Jr. Company, Inc. All available information concerning the construction and reconstruction has been included in Appendix F. The dam is composed of a concrete spillway and two earth embankments the maximum height of which is 48 feet.

2.4 CONSTRUCTION RECORDS

No construction records were located for the dam.

2.5 OPERATION RECORDS

All operation records are on file with the owner.

2.6 EVALUATION OF DATA

The data presented in this report has been, in part, compiled from information obtained from Mr. Robert Mercurio and Mr. Harry Everson of the City of Norwalk, Connecticut. This information appears adequate and reliable for Phase I inspection purposes.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Browns Reservoir Dam was conducted on July 9, 1980. The weather was clear and the temperature ranged in the upper 60's. The water surface at the time of the inspection was just cresting the spillway.

b. Spillway

The concrete spillway located near the left abutment of the dam is stepped to dissipate the energy of the overflow. The construction joints are deteriorated and require repair. Spillway flow masked careful examination of the downstream face. No significant seepage was observed and no seepage was reported by the maintenance staff. (See Photo #1) The approach channel is riprapped and appears to be in good condition. A few stones have been displaced. (See Photo #2) Gravel and stone was noted at the base of the spillway. This area is in good conditoin. The top surfaces of the spillway buttresses are deteriorated (particularly the left buttress) and require repairs. (See Photos #1 & 2). The horizontal and vertical alignment of the spillway appears to be good.

c. Embankment

The embankment is divided into 2 sections by the spillway. The left embankment is in generally good condition. (See Photo #2) Some vegetation was observed on the upstream face near the water line (See Photo #4), and some slight erosion is present near the crest of the embankment left of the left spillway buttress (See Photo #3).

The right embankment is in good condition with the following exceptions:

1. Extensive tree and brush growth on the downstream slope. Some of the trees have been removed by maintenance forces in the vicinity of the spillway, and it was reported that this program would be instituted along the remainder of the embankment. (See Photos #4 & 5)

2. In the vicinity of the spillway approximately 50 feet beyond the toe of the embankment a soft wet area is present, with water seeking vegetation. Mowing equipment has rutted the surface and water is laying in this area. This area may be the result of the backwater at the base of the spillway. (See Photo #3) No evidence of active seepage was observed. Evidence of erosion of the downstream slope about 20 feet from the right spillway buttress was noted. (See Photo #6)

3. In the area adjacent to the downstream toe and slightly to the left of the gate house, seepage was evident at a rate of 5 to 10 gpm. (See Photo #10) The seepage appeared to be originating from an area downstream of the embankment, and was flowing toward the embankment and then turning to the right and flowing toward the outlet works for the gatehouse. No evidence of particle migration was noted.

4. On the left side of the concrete outlet structure, 5 separate and distinct areas were observed in which seepage was flowing toward the outlet structure. (See Photos #8 & 9) Some minor sediment was noted at several locations where the seepage was discharging into the backwater adjacent to the outlet structure. The flows appeared to be clear and no active particle migration was observed. Some of the flow appears to be originating from an elevated area of natural origin, left of the outlet structure. One of the flows originates on the right side near the embankment, flows parallel to the toe and emerges on the left side of the outlet structure. This seepage is being ponded by the irregular grade near the toe, and has a rusty appearance, but the flow is clear. The total quantity of seepage from all areas is estimated to be 20 to 30 gpm. It is possible that some of the flow is related to rains of the previous day. The maintenance staff reports that this seepage has been present for at least 6 years.

While the slopes of the right embankment appears to be steep, no evidence of sliding, sloughing, depressions, or seepage was observed on the slopes, along the crest or at the abutments.

d. Outlet Works

The 1909 plans indicate that the outlet works, located near the right abutment of the right earth embankment, consists of a masonry and concrete gatehouse atop a concrete gate chamber. Three gate valves controls, for a 6", 16", and 30" pipe, were observed in the gate house at the crest of the embankment. (See Photo #7) The outlet chamber (referred to as the "outlet parapet wall" in the 1909 plans) at the downstream toe of the embankment contains two valves (for 16 and 30 inch pipes). (See Photo #8) No valve was observed for the 6" pipe, which appears to be a drain for removal of water within the gate chamber. Maintenance forces were unaware of the existance of the valves within the gate chamber, indicating that these valves had not been operated for some time. Control of the outflow is provided by the downstream valves in the outlet chamber, which indicates that the upstream valves are open at least partially. All valves should be investigated and returned to operational status.

e. Downstream Channels

The downstream channel below the outlet chamber is heavily vegetated. (See Photo #9) The downstream channel below the spillway is also vegetated heavily. This vegetation should be removed to prevent blockage of the outflow.

f. Reservoir

There are no visible signs of instability or sedimentation problems within the reservoir area.

3.2 EVALUATION

The problem areas observed during the inspection and the recommended remedial actions are as follows:

1. The seepage observed along the toe of the dam requires monitoring at bi-weekly intervals with aid of weirs.

2. The soft wet area below the right spillway buttress requires monitoring.

3. The construction joints of the spillway and the spillway buttresses are deteriorated and require repair.

4. Extensive tree and brush growth was observed on the right embankment, the upstream slope of the left embankment and the downstream channels. This vegetation should be cut as soon as possible and a program of periodic cutting and mowing of these surfaces instituted.

5. Minor erosion was observed on the downstream slopes of the embankments near the spillway buttresses. Regrade and seed as required to restore these slopes to their original configuration.

6. Investigate the condition of all valves. Restore these valves, to operational status. Operate the 6 inch drain so that the water within the wet wall is removed and inspect the wall and appurtenances thoroughly. Initiate repairs as required. Use of the upstream valves for control of releases will reduce the internal pressure within the pipes.

7. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of all valves. Document this information for future reference. Also develop an emergency action plan.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The normal water surface elevation is approximated by the crest of the spillway. Water can be released to the downstream channel by the outlet works via the 16 and 30 inch diameter pipes which are currently controlled by the valves in the outlet chamber. By using the valves in the gate house, instead of those in the outlet chamber, excess pressure within the pipe and the embankment will be eliminated. The invert elevation of these pipes within the gate house is 372. A 6 inch diameter pipe and valve located within the gate house may be used to drain the gate house wet wall.

4.2 MAINTENANCE OF THE DAM

Maintenance of the dam is not considered adequate as evidenced by the deterioration of the spillway, extensive vegetation on the embankment and the unoperated valves within the gate house.

4.3 WARNING SYSTEM

There is no warning system in effect or in preparation.

4.4 EVALUATION

The dam and appurtenances have not been maintained in satisfactory condition as noted in "Section 3: Visual Inspection."

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed of Browns Reservoir was made using the USGS quadrangles for Peach Lake, Pound Ridge, New York and Bethel, Norwalk North Connecticut. The basin consists of woodlands and fields with many residences in the lower portion. Relief is moderate, with some upland storage in the form of swampy areas and small ponds. The total area is 7.56 square miles.

5.2 ANALYSIS CRITERIA

The analysis of the spillway capacity of the dam and storage of the reservoir was performed using the Corps of Engineers HEC-1 computer model. The unit hydrograph was defined using the Snyder Synthetic Unit Hydrograph Method and the Modified Puls routing procedure was incorporated. The Probable Maximum Precipitation (PMP) used was 21.7 inches (24 hrs, 200 sq. mi) from Hydrometeorological Report No. 33. Several floods were selected (%'s PMF) for analysis in accordance with recommended guidelines of the Corps of Engineers. The PMF inflow of 10,466 cfs, was routed through the reservoir and the peak outflow was determined to be 10,457 cfs.

5.3 SPILLWAY CAPACITY

A single stepped, masonary overflow spillway is located near the left abutment. It has a width of 175.5' and has a capacity of 3931. cfs at top of dam. Top of dam is 4 feet above spillway crest. There is no auxiliary or emergency spillway at Browns Reservoir.

5.4 RESERVOIR CAPACITY

Normal flood control storage capacity of the reservoir between the spillway crest and top of dam is 176. acre feet. This volume represents a total runoff of .44 inches from the basin.

5.5 FLOODS OF RECORD

Maximum flow observed in the spillway was about 1.5', resulting in an estimated flow of 860 cfs. This flow occurred during September 1975.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway is 3931. cfs before overtopping would occur.

This capacity results in the ability to pass only 38% of the PMF with very little attenuation.

5.7 EVALUATION

The dam will be overtopped in all storms greater than 38% of the PMF. The spillway is, therefore, considered to be seriously inadequate.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

No signs of major distress were observed in connection with the earth embankment or the spillway section. However, seepage was observed at the toe of the right embankment near the gate house, and a soft wet area was noted below the right spillway buttress.

b. Design and Construction Data

No design or construction data could be located concerning the structural stability of the dam.

c. Post-Construction Changes

In 1924, the dam was raised from a crest elevation of 414 to elevation 420. (See Appendix F)

6.2 STABILITY ANALYSIS

A stability analysis was conducted for the concrete gravity spillway section. The results of the analysis are as follows:

Case	Description of Loading Conditions
1	Normal Operating conditions, reservoir at El. 416.5 (spillway crest), full uplift, no tailwater.
2	Same as Case 1, with 5.0 kips/l.f. ice load
3	Water at 1/2 PMF level (El. 420.8) uplift as in Case 1, tailwater = 4.3 feet
4	Water at PMF level (El. 421.6) uplift as in Case 1, tailwater = 5.1 feet
5	Normal conditions as in Case 1, with seismic forces: = 0.1 (seismic Zone 3)

Note: The bottom surface of the dam has been idealized to simplify the analysis. Compare the analyzed section (Appendix E) with the spillway section in Appendix F. Elevations are based on plan datum.

Case	Factor of Safety Overturning	Location of Resultant from Toe	Factor of Safety Sliding
1	3.20	8.8	3.31
2	1.73	5.4	1.41
3	2.30	8.5	1.80
4	2.19	8.4	1.67
5	2.39	7.5	2.06

Location of middle 1/3 is 5.0 to 10.0 feet from the toe.

These results indicate that the spillway portion analyzed has factors of safety in excess of that recommended by the Corps of Engineers. The spillway is, therefore, considered to have adequate factors of safety for stability.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I Inspection of Browns Reservoir Dam revealed that the spillway is "seriously inadequate", based on the Corps of Engineers "screening criteria", and outflows from any storm in excess of 38% of the PMF will overtop the dam. This overtopping could cause breaching of the earth embankment and the resulting flood-wave would significantly increase the hazard to downstream residents. For these reasons the dam has been assessed as unsafe, non-emergency.

b. Adequacy of Information

The information reviewed is considered adequate for Phase I Inspection purposes.

c. Need for Additional Investigation

Since the spillway is considered to be seriously inadequate, additional hydrologic/hydraulic investigations are required to more accurately determine the site specific characteristics of the watershed. After these investigations have been completed, remedial measures must be initiated to provide spillway capacity sufficient to discharge the outflow from the 1/2 PMF event.

d. Urgency

The additional hydrologic/hydraulic investigations must be initiated within 3 months of notification to the owner. Within 1 year, remedial measures as a result of these investigations must be initiated, with completion of these measured during the following year. In the interim, develop an emergency action plan for the notification of downstream residents and the proper governmental authorities in the event of overtopping, and provide around-the-clock surveillance of the dam during periods of extreme run-off. The problem areas listed below must be corrected within 1 year of notification.

7.2 RECOMMENDED MEASURES

1. Monitor the seepage at the toe of slope below the outlet works, at bi-weekly intervals with the aid of weirs. Also monitor the soft wet area below the right spillway buttress.

2. Repair the deteriorated concrete of the spillway and spillway buttresses.

3. Remove the vegetation observed on the embankments and along the downstream channels. Provide a program of periodic cutting and mowing of these surfaces.

4. Repair the minor erosion observed on the downstream slopes of the embankments near the spillway buttresses.

5. Investigate the condition of the wet wall and the valves within the gate house. Repair the valves as required and return to operational status. The valves in the gate house should be used for control instead of those in the outlet chamber to redued the internal pressures

within the pipe and embankment.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances, including yearly operation and lubrication of all valves. Document this information for future reference. The emergency action plan described in section 7.1d should be maintained and updated periodically during the life of the structure.

APPENDIX A

PHOTOGRAPHS

Photo #2 Spillway Looking at Left Embankment

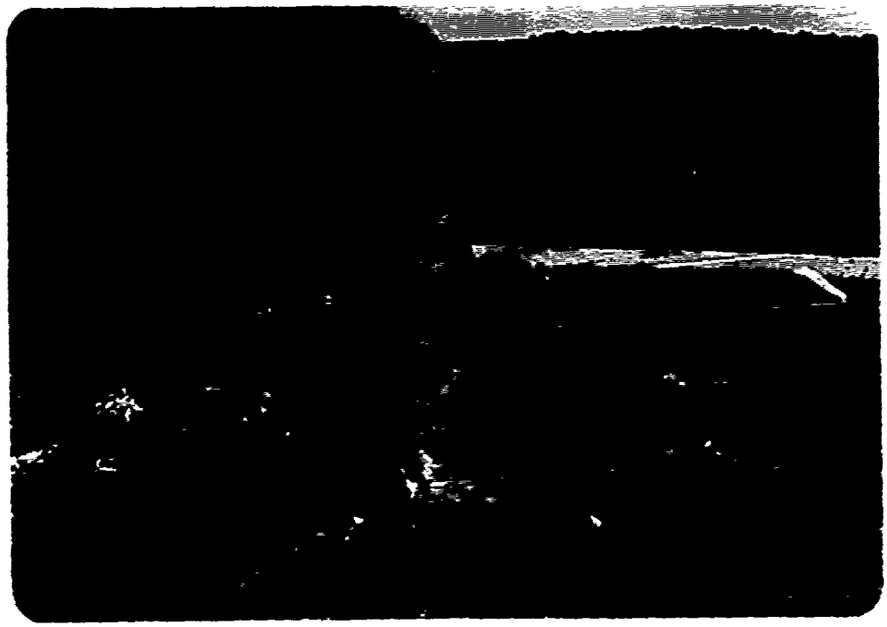


Photo #3 Spillway Looking at Right Embankment

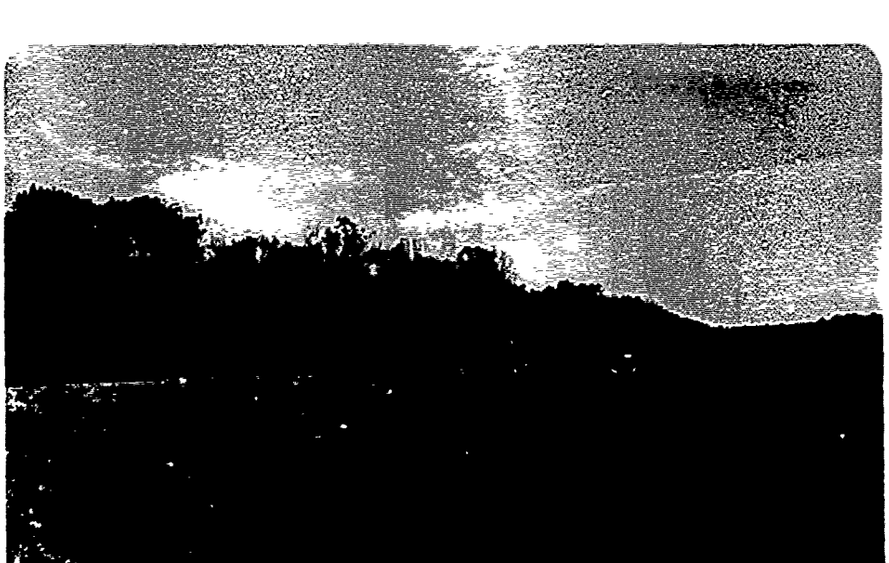


Photo #4 Upstream Face - Left Embankment

Photo #5 Crest - Right Embankment

Photo #6 Erosion of Right Embankment
near spillway

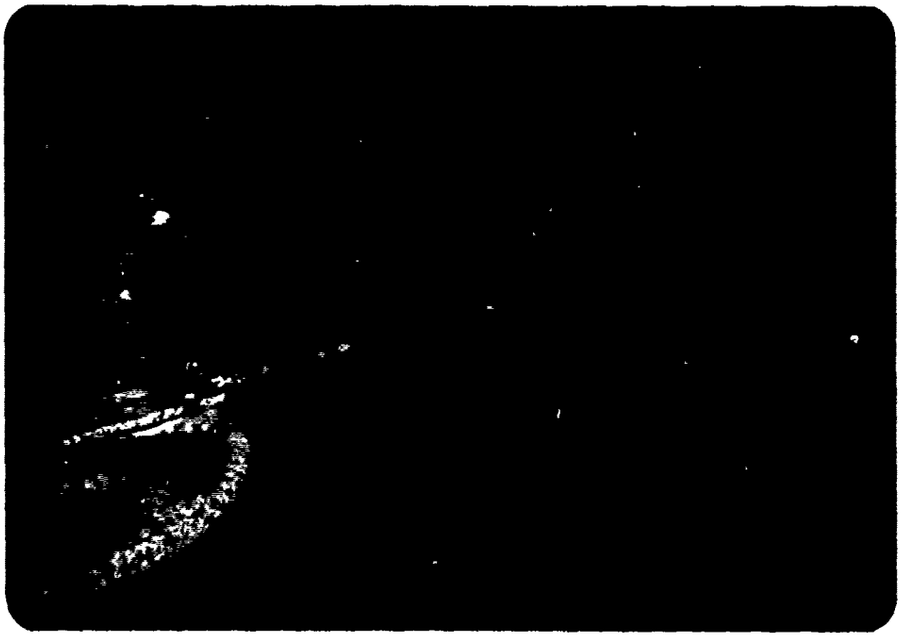


Photo #7 Valve Control in Gate House

Photo #8 Outlet Structure
note seepage in foreground

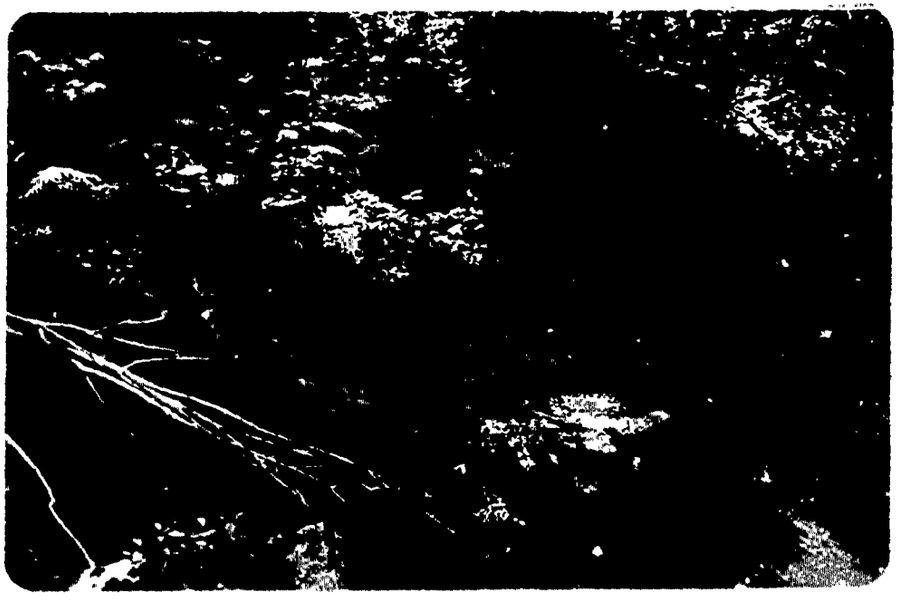


Photo #9 Seepage at Left of Outlet Structure

Photo #10 Seepage Left of Outlet Structure

APPENDIX B

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Browns Reservoir

Fed. I.D. # NY 763 DEC Dam No. 232 BE-4361

River Basin Long Island

Location: Town Lewisboro County Westchester

Stream Name Silvermine River

Tributary of Long Island Sound

Latitude (N) 41° 12.9' Longitude (W) 73° 29.6'

Type of Dam Homogeneous earth embankment w/ concrete spillway

Hazard Category "C" High

Date(s) of Inspection July 9, 1980

Weather Conditions Clear upper 60°'s

Reservoir Level at Time of Inspection approximately the spillway crest

b. Inspection Personnel James C. Veatch Robert P. McCarthy

c. Persons Contacted (Including Address & Phone No.)

Robert Marcucio, Harry Everson maintenance division

Norwalk Water District, 3 Aiken Ave, Norwalk Conn

(203) 866-1473 - Mr. William Leahy - Supt.

Filter Plant & [illegible]

d. History:

Date Constructed 1910 Date(s) Reconstructed 1922 raised 6 ft [illegible]

Designer [illegible] (1910) [illegible]

Constructed By [illegible] Hecker Co [illegible] (1910) [illegible] 1922

Owner City of Norwalk Conn

2) Embankment

a. Characteristics

(1) Embankment Material [illegible]

(2) Cutoff Type concrete & cyclopean masonry

(3) Impervious Core Same as (2)

(4) Internal Drainage System none

(5) Miscellaneous

b. Crest

(1) Vertical Alignment good

(2) Horizontal Alignment good

(3) Surface Cracks none

(4) Miscellaneous

c. Upstream Slope

(1) Slope (Estimate) (V:H) 1:2

(2) Undesirable Growth or Debris, Animal Burrows [illegible]

(3) Sloughing, Subsidence or Depressions [illegible]

(4) Slope Protection riprapped

(5) Surface Cracks or Movement at Toe

unobservable

d. Downstream Slope

(1) Slope (Estimate - V:H) 1:1.5

(2) Undesirable Growth or Debris, Animal Burrows

Lots of vegetation

(3) Sloughing, Subsidence or Depressions none evident

(4) Surface Cracks or Movement at Toe none evident

(5) Seepage Seepage in area surrounding outlet chamber below right embankment from 5 separate areas flowing into low area near outlet [illegible] in outlet pool. Flow observed ≈ 20 to 30 gpm. See

(6) External Drainage System (Ditches, Trenches; Blanket) none

Seepage coming from high natural ground area below [illegible] of dam. Seepage appeared to be there [illegible]

(7) Condition Around Outlet Structure

backwater from channel around outlet, concrete good.

(8) Seepage Beyond Toe see (5) above

e. Abutments - Embankment Contact

[illegible]

(1) Erosion at Contact [illegible]

(2) Seepage Along Contact [illegible]

3) Drainage System

a. Description of System [illegible]

b. Condition of System

c. Discharge from Drainage System

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) [illegible]

5) Reservoir

a. Slopes good condition

b. Sedimentation no problems reported

c. Unusual Conditions Which Affect Dam

Scotts Rd spillway on west Branch Silvermine R.

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.)

2 dam water supply dams + city of Norwalk 3 mi

b. Seepage, Unusual Growth heavily vegetated

no seepage @ 2.25

c. Evidence of Movement Beyond Toe of Dam

none

d. Condition of Downstream Channel vegetated slight backwater

7) Spillway(s) (Including Discharge Conveyance Channel)

a. General concrete added in 1974 to increase

height of dam

b. Condition of Service Spillway good

c. Condition of Auxiliary Spillway _____

Dam

d. Condition of Discharge Conveyance Channel _____

access road ≈ 100' downstream

8) Reservoir Drain/Outlet

Type: Pipe ~~_____~~ Conduit _____ Other _____

Material: Concrete _____ Metal ~~_____~~ Other _____

Size: 6" galvanized to 16"CMP Length unknown

Invert Elevations: Entrance unknown Exit unknown

Physical Condition (Describe): Unobservable ~~_____~~

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

_____

Hydraulic Capability: _____

_____

Means of Control: Gate _____ Valve ~~_____~~ Uncontrolled _____

Operation: Operable unknown Inoperable unknown Other _____

Present Condition (Describe): _____

_____

9) <u>Structural</u>

a. Concrete Surfaces generally good condition
some deterioration of upper surfaces
of buttresses / spillway

b. Structural Cracking none of significance

c. Movement - Horizontal & Vertical Alignment (Settlement)
none noted

d. Junctions with Abutments or Embankments
good condition

e. Drains - Foundation, Joint, Face
none

f. Water Passages, Conduits, Sluices
underwater repair operation

g. Seepage or Leakage see 3 & 5

h. Joints - Construction, etc. _____

i. Foundation _____

j. Abutments _____

k. Control Gates _____

l. Approach & Outlet Channels _____

m. Energy Dissipators (Plunge Pool, etc.) _____

n. Intake Structures _____

o. Stability _____

p. Miscellaneous _____

APPENDIX C

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	436	55	1067
2) Design High Water (Max. Design Pool)	—	—	—
3) Auxiliary Spillway Crest	—	—	—
4) Pool Level with Flashboards	—	—	—
5) Service Spillway Crest	432	44	891

DISCHARGES

	Volume (cfs)
1) Average Daily	12.
2) Spillway @ Maximum High Water – TOP OF DAM –	3931.
3) Spillway @ Design High Water	—
4) Spillway @ Auxiliary Spillway Crest Elevation	—
5) Low Level Outlet	190.
6) Total (of all facilities) @ Maximum High Water	4121.
7) Maximum Known Flood	860.
8) At Time of Inspection	5-10 cfs.

CREST: ELEVATION: 436.0

Type: HOMOGENEOUS EARTH W/ CYCLOPEAN CONCRETE CORE WALL

Width: 14' Length: 1200'

Spillover LEFT CENTER, STEPPED CONCRETE

Location

SPILLWAY:

SERVICE		AUXILIARY
432.0	Elevation	—
STEPPED CONCRETE OVERFLOW	Type	—
175.5'	Width	—
	Type of Control	
✓	Uncontrolled	—
	Controlled:	
—	Type (Flashboards; gate)	—
—	Number	—
—	Size/Length	—
	Invert Material	—
	Anticipated Length of operating service	—
—	Chute Length	—
2H to 1V APPROACH	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	—

HYDROMETEROLOGICAL GAGES:

Type : NONE

Location: —

Records:

Date - —

Max. Reading - —

FLOOD WATER CONTROL SYSTEM:

Warning System: NONE

Method of Controlled Releases (mechanisms):

16" & 30" RESERVOIR DRAIN
TO FEED LOWER WATER SUPPLY RESERVOIRS

DRAINAGE AREA: 7.56 SQ. MILES

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: WOODED - Some Residential

Terrain - Relief: Moderate slope - well defined drainage paths

Surface - Soil: Good permiability

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

NONE

Potential Sedimentation problem areas (natural or man-made; present or future)

NONE APPARENT

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

No

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: NONE

Elevation: _____

Reservoir:

Length @ Maximum Pool 2500 ft. ~~(Miles)~~

Length of Shoreline (@ Spillway Crest) 7200 ft. ~~(Miles)~~

```
******************************               ******************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)              NEW YORK STATE
DAM SAFETY VERSION       JULY 1978            DEPT OF ENVIRONMENTAL CONSERVATION
LAST MODIFICATION   26 FEB 79                 FLOOD PROTECTION BUREAU
MODIFIED FOR HONEYWELL  APR 79
******************************               ******************************

            A1    PECNFIS RESERVOIR
            A2    PHASE I
            A3    FILE
            B     200
            B1      5         0        15         0         0         0         C         0         0         C
            J       1         0         1
            J1     .2        .4        .5        .6        .8         1
            K       0         1                             2                   1
            K1    INFLOW FROM BASIN
            M       1        .1      7.56
            P               21.7      .111       123       133       142
            T
            X    2.42      .025                                                 1        .1
            X    -2.0      -.05         1
            K       1         1                             2                   1
            K1    ROUTE THROUGH RESERVOIR
            Y
            Y1      1                             1         1
            Y4    432     432.1      433.       434       435       436     -432.        -1
            Y5               157       445      1336      2490      3931       427       438
            $S                56      +157       427       602       803      6024      8303
            $E    396       410       410       420       425       430       891
            $$    432                                                         422
            $D    434                  1.5      1200
            K      99
            A
            A
            A
            A
            A
```

```
PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS
        RUNOFF HYDROGRAPH AT                    1
        ROUTE HYDROGRAPH TO                     1
        END OF NETWORK
```

```
******************************                                            ******************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)                                          NEW YORK STATE
DAM SAFETY VERSION       JULY 1978                                        DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION 26 FEB 79                                             FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL Jan 79
******************************                                            ******************************

RUN DATE 02/27/80.
            ROBINS RESERVOIR
            PHASE I
            PMF

                                    JOB SPECIFICATION
      NQ     NHR    NMIN    IDAY    IHR     IMIN    METRC    IPLT    IPRT    NSTAN
      200              15      0      0       0       0        0       0       0
                            JOPER   NWT     LROPT   TRACE
                              5      0        0       0

                           MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 6 LRTIO= 1
      RTIOS=   0.20    0.40    0.50    0.60    0.80    1.00

**********         **********         **********         **********         **********

                              SUB-AREA RUNOFF COMPUTATION
      INFLOW FROM BASIN
                 ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT   INAME  ISTAGE  IAUTO
                   1       0       0       0      2      0       1      0       0
                                     HYDROGRAPH DATA
      IHYDG   IUHG   TAREA   SNAP    TRSDA    TRSPC   RATIO   ISNOW   ISAME   LOCAL
        1      1     7.56     0.      7.56     0.      0.       0       0       0
                                      PRECIP DATA
             SPFE    PMS      R6      R12      R24      R48      R72      R96
              0.    21.70   111.00   123.00   133.00   142.00     0.       0.
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                        LOSS DATA
      LROPT  STRKR  DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
        0      0.     0.     1.00     0.      0.     1.00    1.00    0.10     0.      0.
                                  UNIT HYDROGRAPH DATA
                           TP=  5.72     CP=0.63     NTA=  0
                                     RECESSION DATA
                        STRTQ=   -2.00     QRCSN=   -0.05     RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=21.92 AND R=15.59 INTERVALS

        UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG=  5.61 HOURS, CP= 0.63  VOL= 0.99
     7.      27.      55.      88.     126.     166.     209.     259.     300.     358.
   397.     444.     487.     525.     557.     583.     604.     619.     628.     631.
   627.     612.     587.     555.     527.     500.     472.     447.     425.     403.
   382.     362.     342.     325.     308.     292.     276.     262.     248.     235.
   223.     211.     200.     190.     180.     170.     161.     153.     145.     137.
   130.     123.     117.     111.     105.      99.      94.      89.      85.      80.
    76.      72.      68.      65.      61.      58.      55.      52.      49.      47.
    44.      42.      40.      38.      36.      34.      32.      31.      29.      27.
    26.      25.      23.      22.      21.      20.      19.      18.      17.      16.
    15.      14.      14.      13.      12.      12.      11.      11.      10.       9.
```

END-OF-PERIOD FLOW

1.01	0.15	1	0.00	0.	0.00	15.	1.02	1.15	101	0.03	0.01	0.02	91.
1.01	0.30	2	0.00	0.	0.00	15.	1.02	1.30	102	0.03	0.00	0.02	87.
1.01	0.45	3	0.00	0.	0.00	15.	1.02	1.45	103	0.03	0.00	0.02	85.
1.01	1.00	4	0.00	0.	0.00	15.	1.02	2.00	104	0.03	0.00	0.02	84.
1.01	1.15	5	0.00	0.	0.00	15.	1.02	2.15	105	0.03	0.00	0.02	81.
1.01	1.30	6	0.00	0.	0.00	15.	1.02	2.30	106	0.03	0.00	0.02	78.
1.01	1.45	7	0.00	0.	0.00	15.	1.02	2.45	107	0.03	0.00	0.02	77.
1.01	2.00	8	0.00	0.	0.00	15.	1.02	3.00	108	0.03	0.00	0.02	75.
1.01	2.15	9	0.00	0.	0.00	15.	1.02	3.15	109	0.03	0.00	0.02	73.
1.01	2.30	10	0.00	0.	0.00	15.	1.02	3.30	110	0.03	0.00	0.02	74.
1.01	2.45	11	0.00	0.	0.00	15.	1.02	3.45	111	0.03	0.00	0.02	74.
1.01	3.00	12	0.00	0.	0.00	15.	1.02	4.00	112	0.03	0.00	0.02	74.
1.01	3.15	13	0.00	0.	0.00	15.	1.02	4.15	113	0.03	0.00	0.02	74.
1.01	3.30	14	0.00	0.	0.00	15.	1.02	4.30	114	0.03	0.00	0.02	73.
1.01	3.45	15	0.00	0.	0.00	15.	1.02	4.45	115	0.03	0.00	0.02	73.
1.01	4.00	16	0.00	0.	0.00	15.	1.02	5.00	116	0.03	0.00	0.02	76.
1.01	4.15	17	0.00	0.	0.00	15.	1.02	5.15	117	0.03	0.00	0.02	77.
1.01	4.30	18	0.00	0.	0.00	15.	1.02	5.30	118	0.03	0.00	0.02	76.
1.01	4.45	19	0.00	0.	0.00	15.	1.02	5.45	119	0.03	0.00	0.02	76.
1.01	5.00	20	0.00	0.	0.00	15.	1.02	6.00	120	0.03	0.00	0.02	79.
1.01	5.15	21	0.00	0.	0.00	15.	1.02	6.15	121	0.03	0.00	0.02	80.
1.01	5.30	22	0.00	0.	0.00	15.	1.02	6.30	122	0.03	0.00	0.02	82.
1.01	5.45	23	0.00	0.	0.00	15.	1.02	6.45	123	0.03	0.00	0.02	90.
1.01	6.00	24	0.00	0.	0.00	15.	1.02	7.00	124	0.03	0.00	0.02	92.
1.01	6.15	25	0.01	0.	0.01	15.	1.02	7.15	125	0.03	0.00	0.02	100.
1.01	6.30	26	0.01	0.	0.01	15.	1.02	7.30	126	0.03	0.00	0.02	110.
1.01	6.45	27	0.01	0.	0.01	15.	1.02	7.45	127	0.03	0.00	0.02	122.
1.01	7.00	28	0.01	0.	0.01	15.	1.02	8.00	128	0.03	0.00	0.02	137.
1.01	7.15	29	0.01	0.	0.01	15.	1.02	8.15	129	0.03	0.00	0.02	153.
1.01	7.30	30	0.01	0.	0.01	15.	1.02	8.30	130	0.03	0.00	0.02	170.
1.01	7.45	31	0.01	0.	0.01	15.	1.02	8.45	131	0.03	0.00	0.02	189.
1.01	8.00	32	0.01	0.	0.01	15.	1.02	9.00	132	0.03	0.00	0.02	209.
1.01	8.15	33	0.01	0.	0.01	15.	1.02	9.15	133	0.03	0.00	0.02	230.
1.01	8.30	34	0.01	0.	0.01	15.	1.02	9.30	134	0.03	0.00	0.02	253.
1.01	8.45	35	0.01	0.	0.01	15.	1.02	9.45	135	0.03	0.00	0.02	277.
1.01	9.00	36	0.01	0.	0.01	15.	1.02	10.00	136	0.03	0.00	0.02	301.
1.01	9.15	37	0.01	0.	0.01	15.	1.02	10.15	137	0.03	0.00	0.02	326.
1.01	9.30	38	0.01	0.	0.01	15.	1.02	10.30	138	0.03	0.00	0.02	352.
1.01	9.45	39	0.01	0.	0.01	15.	1.02	10.45	139	0.03	0.00	0.02	379.
1.01	10.00	40	0.01	0.	0.01	15.	1.02	11.00	140	0.03	0.00	0.02	406.
1.01	10.15	41	0.01	0.	0.01	15.	1.02	11.15	141	0.03	0.00	0.02	434.
1.01	10.30	42	0.01	0.	0.01	15.	1.02	11.30	142	0.03	0.00	0.02	462.
1.01	10.45	43	0.01	0.	0.01	15.	1.02	11.45	143	0.03	0.00	0.02	491.
1.01	11.00	44	0.01	0.	0.01	15.	1.02	12.00	144	0.03	0.00	0.02	520.
1.01	11.15	45	0.01	0.	0.01	15.	1.02	12.15	145	0.48	0.46	0.02	550.
1.01	11.30	46	0.01	0.	0.01	15.	1.02	12.30	146	0.48	0.46	0.02	580.
1.01	11.45	47	0.01	0.	0.01	15.	1.02	12.45	147	0.48	0.46	0.02	611.
1.01	12.00	48	0.01	0.	0.01	15.	1.02	13.00	148	0.48	0.46	0.02	642.
1.01	12.15	49	0.03	0.	0.03	15.	1.02	13.15	149	0.55	0.53	0.02	674.
1.01	12.30	50	0.03	0.	0.03	15.	1.02	13.30	150	0.55	0.53	0.02	706.
1.01	12.45	51	0.03	0.	0.03	15.	1.02	13.45	151	0.55	0.53	0.02	1099.
1.01	13.00	52	0.03	0.	0.03	15.	1.02	14.00	152	0.51	0.55	0.02	1229.
1.01	13.15	53	0.04	0.	0.04	15.	1.02	14.15	153	0.72	0.70	0.02	1370.
1.01	13.30	54	0.04	0.	0.04	15.	1.02	14.30	154	0.72	0.70	0.02	1523.
1.01	13.45	55	0.04	0.	0.04	15.	1.02	14.45	155	0.72	0.70	0.02	1719.
1.01	14.00	56	0.04	0.	0.04	15.	1.02	15.00	156	0.72	0.70	0.02	1949.
1.01	14.15	57	0.05	0.	0.05	15.	1.02	15.15	157	0.73	0.71	0.02	2200.
1.01	14.30	58	0.05	0.	0.05	15.	1.02	15.30	158	1.45	1.44	0.02	2520.
1.01	14.45	59	0.05	0.	0.05	15.	1.02	15.45	159	1.10	1.08	0.02	2967.
1.01	15.00	60	0.15	0.	0.05	15.	1.02	16.00	160	1.03	1.00	0.02	3700.
1.01	15.15	61	0.09	0.	0.09	15.	1.02	16.15	161	0.67	0.65	0.02	3796.
1.01	15.30	62	0.10	0.	0.10	15.	1.02	16.30	162	0.67	0.65	0.02	4290.
1.01	15.45	63	0.20	0.09	0.10	16.	1.02	16.45	163	1.07	0.65	0.02	4790.

1.01	16.00	64	[illegible]	[illegible]	[illegible]	[illegible]
1.01	16.15	65	0.05	0.02	0.03	21.
1.01	16.30	66	0.05	0.02	0.03	26.
1.01	16.45	67	0.05	0.02	0.03	32.
1.01	17.00	68	0.05	0.02	0.03	39.
1.01	17.15	69	0.04	0.01	0.03	47.
1.01	17.30	70	0.04	0.01	0.03	56.
1.01	17.45	71	0.04	0.01	0.03	66.
1.01	18.00	72	0.04	0.01	0.03	77.
1.01	18.15	73	0.00	0.	0.00	88.
1.01	18.30	74	0.00	0.	0.00	99.
1.01	18.45	75	0.00	0.	0.00	111.
1.01	19.00	76	0.00	0.	0.00	122.
1.01	19.15	77	0.00	0.	0.00	132.
1.01	19.30	78	0.00	0.	0.00	141.
1.01	19.45	79	0.00	0.	0.00	150.
1.01	20.00	80	0.00	0.	0.00	157.
1.01	20.15	81	0.00	0.	0.00	163.
1.01	20.30	82	0.00	0.	0.00	167.
1.01	20.45	83	0.00	0.	0.00	170.
1.01	21.00	84	0.00	0.	0.00	171.
1.01	21.15	85	0.00	0.	0.00	170.
1.01	21.30	86	0.00	0.	0.00	167.
1.01	21.45	87	0.00	0.	0.00	163.
1.01	22.00	88	0.00	0.	0.00	159.
1.01	22.15	89	0.00	0.	0.00	153.
1.01	22.30	90	0.00	0.	0.00	147.
1.01	22.45	91	0.00	0.	0.00	142.
1.01	23.00	92	0.00	0.	0.00	135.
1.01	23.15	93	0.00	0.	0.00	129.
1.01	23.30	94	0.00	0.	0.00	124.
1.01	23.45	95	0.00	0.	0.00	118.
1.02	0.	96	0.00	0.	0.00	112.
1.02	0.15	97	[illegible]	[illegible]	0.03	107.
1.02	0.30	98	[illegible]	[illegible]	0.03	103.
1.02	0.45	99	[illegible]	0.00	0.03	98.
1.02	1.00	100	[illegible]	[illegible]	0.03	94.

1.02	17.15	165	0.53	0.50	0.02	5916.
1.02	17.30	166	0.53	0.50	0.02	6451.
1.02	17.45	167	0.53	0.50	0.02	7061.
1.02	18.00	168	0.53	0.50	0.02	7621.
1.02	18.15	169	0.04	0.02	0.03	8103.
1.02	18.30	170	0.04	0.02	0.03	8671.
1.02	18.45	171	0.04	0.02	0.03	9125.
1.02	19.00	172	0.04	0.02	0.03	9517.
1.02	19.15	173	0.04	0.02	0.03	9844.
1.02	19.30	174	0.04	0.02	0.03	10104.
1.02	19.45	175	0.04	0.02	0.03	10295.
1.02	20.00	176	0.04	0.02	0.03	10415.
1.02	20.15	177	0.04	0.02	0.03	10460.
1.02	20.30	178	0.04	0.02	0.03	10446.
1.02	20.45	179	0.04	0.02	0.03	10353.
1.02	21.00	180	0.04	0.02	0.03	10171.
1.02	21.15	181	0.04	0.02	0.03	9910.
1.02	21.30	182	0.04	0.02	0.03	9599.
1.02	21.45	183	0.04	0.02	0.03	9266.
1.02	22.00	184	0.04	0.02	0.03	8921.
1.02	22.15	185	0.04	0.02	0.03	[illegible]
1.02	22.30	186	0.04	0.02	0.03	[illegible]
1.02	22.45	187	0.04	0.02	0.03	7536.
1.02	23.00	188	0.04	0.02	0.03	7469.
1.02	23.15	189	0.04	0.02	0.03	7110.
1.02	23.30	190	0.04	0.02	0.03	6766.
1.02	23.45	191	0.04	0.02	0.03	6425.
1.03	0.	192	0.04	0.02	0.03	6106.
1.03	0.15	193	0.	0.	0.	[illegible]
1.03	0.30	194	0.	0.	0.	5523.
1.03	0.45	195	0.	0.	0.	5252.
1.03	1.00	196	0.	0.	0.	4999.
1.03	1.15	197	0.	0.	0.	4754.
1.03	1.30	198	0.	0.	0.	4519.
1.03	1.45	199	0.	0.	0.	4296.
1.03	2.00	200	0.	0.	0.	4080.

SUM 24.65 20.65 3.70 334473.
(626.)(532.)(94.)(9527.65)

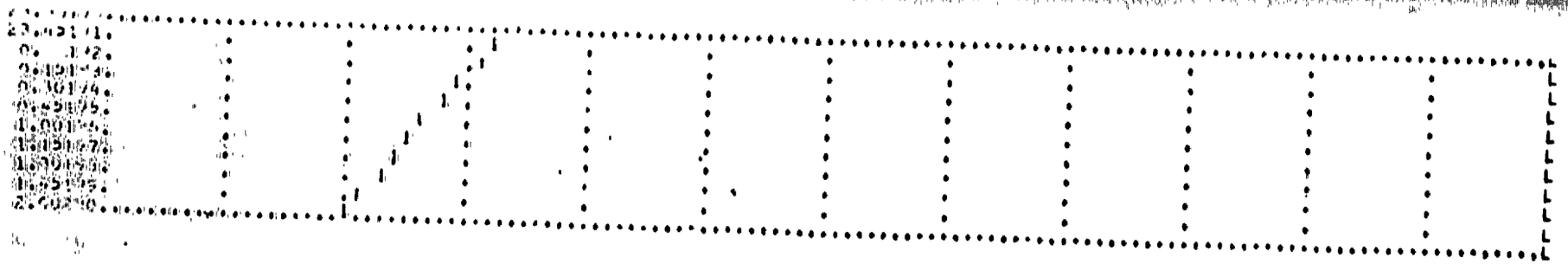
	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10465.	8990.	3427.	1672.	334431.
CMS	296.	255.	97.	47.	9470.
INCHES		11.06	16.87	17.15	17.15
MM		280.96	428.45	435.51	435.51
AC-FT		4458.	6798.	6910.	6910.
THOUS CU M		5498.	8385.	8523.	8523.

STATION 1

FLOW(I), SIMULATED AND OBSERVED FLOW(*)

0.	2000.	4000.	6000.	8000.	10000.	12000.	0.	0.	0.	0.	0.	0.
%	%	%	%	%	%	%	%	%	%	%	%	%
0.15	11											
0.30	21											
0.45	31											
1.00	41											
1.15	51											
1.30	61											
1.45	71											
2.00	81											
2.15	91											
2.30	101											
2.45	111											
3.00	121											
3.15	131											
3.30	141											
3.45	151											
4.00	161											
4.15	171											
4.30	181											
4.45	191											
5.00	201											
5.15	211											
5.30	221											
5.45	231											
6.00	241											
6.15	251											
6.30	261											
6.45	271											
7.00	281											
7.15	291											
7.30	301											
7.45	311											
8.00	321											
8.15	331											
8.30	341											
8.45	351											
9.00	361											
9.15	371											
9.30	381											
9.45	391											
10.00	401											
10.15	411											
10.30	421											
10.45	431											
11.00	441											
11.15	451											
11.30	461											
11.45	471											
12.00	481											
12.15	491											
12.30	501											
12.45	511											
13.00	521											
13.15	531											
13.30	541											
13.45	551											
14.00	561											
14.15	571											

PERCENTAGE(L) AND EXCESS(X)



*3.14

[illegible] *** TOP OF DAM, BOTTOM OF BREACH, OR LOW-LEVEL OUTLET IS NOT WITHIN RANGE OF GIVEN ELEVATIONS IN STORAGE-ELEVATION DATA
BOTTOM OF RESERVOIR ASSUMED TO BE AT 390.00
STORAGE-ELEVATION DATA WILL BE EXTRAPOLATED ABOVE ELEVATION 432.00

STATION 1, PLAN 1, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

1.	2.	3.	3.	4.	5.	5.	6.	6.	6.
4.	6.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	8.	8.	9.	9.	11.	12.	14.
16.	19.	22.	26.	27.	34.	38.	42.	46.	51.
54.	60.	62.	66.	69.	71.	72.	73.	74.	75.
74.	72.	72.	71.	71.	68.	66.	64.	62.	60.
57.	56.	54.	53.	51.	49.	48.	46.	45.	44.
43.	42.	42.	41.	41.	40.	40.	40.	40.	40.
40.	40.	40.	41.	42.	43.	45.	47.	52.	56.
61.	66.	75.	82.	91.	103.	115.	127.	140.	154.
174.	195.	221.	244.	261.	285.	305.	327.	354.	382.
417.	498.	519.	540.	673.	759.	859.	971.	1098.	1249.
1641.	1830.	2020.	2140.	2456.	2777.	3086.	3361.	3667.	3954.
4397.	4682.	4847.	4971.	5109.	5152.	5227.	5232.	5197.	5167.
5028.	4879.	4716.	4544.	4371.	4200.	4030.	3851.	3767.	3615.
3454.	3299.	3134.	2962.	2835.	2657.	2506.	2341.	2349.	2237.

STORAGE

891.	891.	891.	891.	892.	892.	892.	892.	892.	892.
892.	892.	892.	892.	892.	892.	892.	892.	892.	892.
892.	892.	892.	892.	892.	892.	892.	892.	892.	892.
892.	892.	892.	892.	892.	892.	892.	892.	892.	892.
892.	892.	892.	892.	892.	892.	892.	892.	892.	892.
892.	892.	892.	892.	892.	892.	892.	892.	892.	892.
892.	892.	892.	892.	893.	892.	892.	893.	893.	893.
893.	894.	894.	894.	894.	896.	895.	897.	897.	895.
894.	895.	895.	900.	903.	901.	901.	901.	901.	901.
901.	901.	901.	901.	901.	902.	902.	900.	899.	899.
897.	898.	898.	898.	898.	898.	897.	897.	897.	897.
897.	897.	897.	897.	895.	896.	896.	896.	896.	897.
896.	896.	898.	897.	897.	897.	897.	897.	899.	899.
897.	900.	901.	902.	906.	905.	907.	909.	910.	912.
914.	916.	917.	919.	921.	922.	923.	925.	927.	929.
940.	940.	938.	941.	945.	950.	955.	961.	967.	975.
989.	992.	1002.	1012.	1022.	1032.	1041.	1051.	1059.	1067.
1073.	1079.	1077.	1079.	1077.	1076.	1081.	1081.	1081.	1059.
1079.	1070.	1070.	1075.	1073.	1071.	1069.	1065.	1062.	1057.
1052.	1047.	1043.	1038.	1034.	1029.	1025.	1021.	1017.	1013.

STAGE

432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.2
432.2	432.2	432.2	432.2	432.2	432.2	432.2	432.2	432.2	432.2

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
432.2	432.2	432.2	432.2	432.2	432.2	432.1	432.1	432.1	432.1
432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1
432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1	432.1
432.2	432.2	432.2	432.3	432.3	432.3	432.4	432.4	432.4	432.4
432.5	432.5	432.6	432.6	432.7	432.7	432.7	432.8	432.8	432.9
432.9	433.0	433.1	433.1	433.2	433.3	433.5	433.6	433.7	433.9
434.1	434.3	434.5	434.7	435.0	435.2	435.4	435.6	435.8	436.0
436.1	436.2	436.2	436.3	436.3	436.3	436.3	436.3	436.3	436.2
436.3	436.2	436.2	436.2	436.1	436.1	436.0	436.0	435.9	435.8
435.7	435.6	435.4	435.3	435.2	435.1	435.1	435.0	434.9	434.8

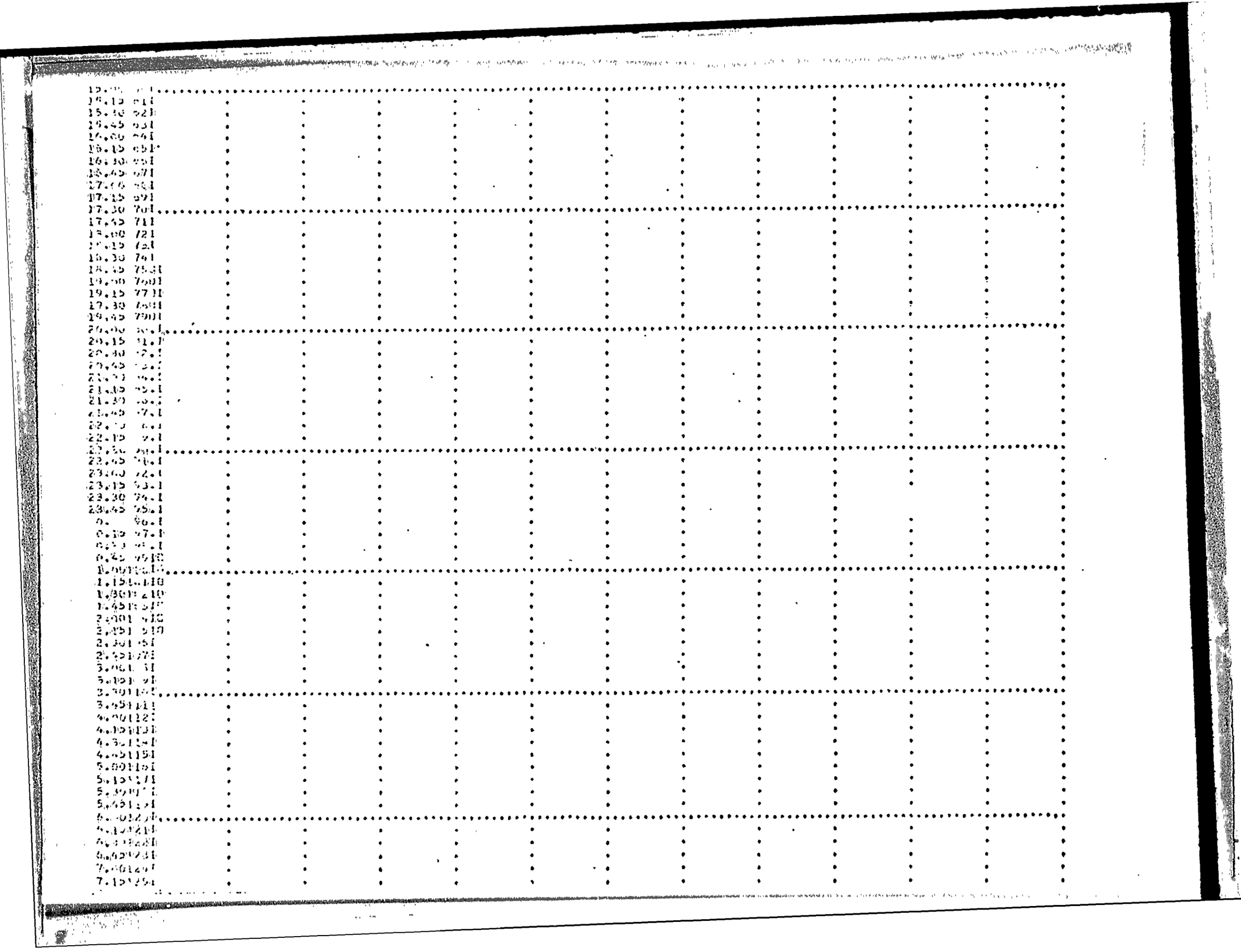
PEAK OUTFLOW IS 5220. AT TIME 44.50 HOURS

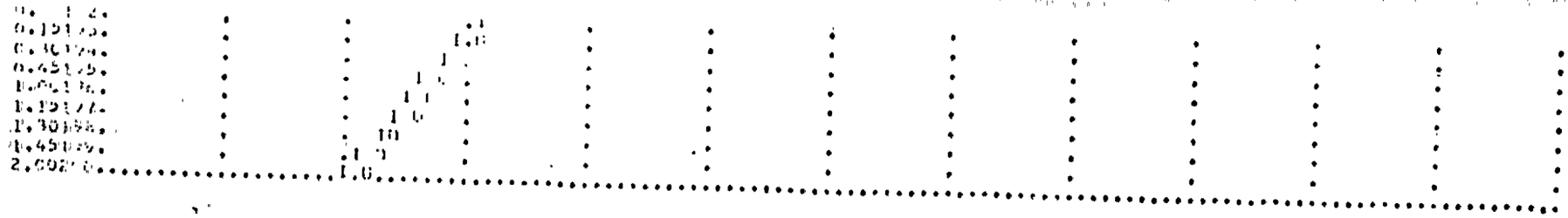
	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5220.	4474.	1655.	206.	184253.
CMS	148.	127.	47.	23.	5217.
INCHES		5.51	8.15	8.27	8.27
MM		139.84	206.55	210.04	210.04
*C-FT		2219.	3293.	3332.	3332.
THOUS CU M		2737.	4060.	4111.	4111.

STATION 1

(+) FLOW (I), OUTFLOW (O) AND OBSERVED FLOW (*)

	1000.	2000.	3000.	4000.	5000.	6000.	0.	0.	0.	0.	0.	0.
0.15	1I											
0.30	2I											
0.45	3I											
1.00	4I											
1.15	5I											
1.30	6I											
1.45	7I											
2.00	8I											
2.15	9I											
2.30	10I											
2.45	11I											
3.00	12I											
3.15	13I											
3.30	14I											
3.45	15I											
4.00	16I											
4.15	17I											
4.30	18I											
4.45	19I											
5.00	20I											
5.15	21I											
5.30	22I											
5.45	23I											
6.00	24I											
6.15	25I											
6.30	26I											
6.45	27I											
7.00	28I											
7.15	29I											
7.30	30I											
7.45	31I											
8.00	32I											
8.15	33I											
8.30	34I											
8.45	35I											
9.00	36I											
9.15	37I											
9.30	38I											
9.45	39I											
10.00	40I											
10.15	41I											
10.30	42I											
10.45	43I											
11.00	44I											
11.15	45I											
11.30	46I											
11.45	47I											
12.00	48I											
12.15	49I											
12.30	50I											
12.45	51I											
13.00	52I											
13.15	53I											
13.30	54I											
13.45	55I											
14.00	56I											
14.15	57I											
14.30	58I											
14.45	59I											





[illegible]

WARNING *** TOP OF DAM, SPILLWAY CREST OR LOW-LEVEL OUTLET IS NOT WITHIN RANGE OF GIVEN ELEVATIONS IN STORAGE-ELEVATION DATA
BOTTOM OF RESERVOIR ASSUMED TO BE AT 390.00
STORAGE-ELEVATION DATA WILL BE EXTRAPOLATED ABOVE ELEVATION 432.00

STATION 1, PLAN 1, RATIO 6

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

2.	4.	6.	7.	8.	9.	10.	11.	11.	12.
12.	13.	13.	13.	14.	14.	14.	14.	14.	14.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
15.	15.	15.	15.	16.	17.	19.	21.	24.	25.
33.	38.	44.	51.	57.	67.	75.	[illegible]	93.	101.
107.	117.	125.	131.	137.	141.	145.	147.	149.	149.
148.	147.	145.	142.	139.	136.	132.	128.	124.	120.
114.	112.	109.	105.	102.	99.	96.	93.	91.	88.
86.	85.	83.	82.	81.	80.	80.	79.	79.	79.
79.	79.	80.	81.	83.	86.	91.	95.	103.	112.
123.	135.	150.	170.	203.	236.	265.	303.	337.	372.
[illegible]	444.	483.	529.	570.	609.	651.	657.	750.	814.
889.	[illegible]	1053.	1214.	1371.	1505.	1811.	2050.	2330.	2677.
3109.	3535.	4119.	5071.	5667.	6279.	6904.	7429.	7597.	[illegible]
8954.	[illegible]	9754.	10037.	10247.	10358.	10457.	10454.	10381.	10225.
9947.	9668.	9767.	9027.	8671.	8311.	7947.	7585.	7227.	6877.
6544.	6221.	5918.	5632.	5363.	5102.	4857.	4625.	4407.	4201.

STORAGE

[illegible]	[illegible]	892.	892.	892.	892.	892.	[illegible]	[illegible]	893.
[illegible]	893.	893.	893.	893.	893.	893.	[illegible]	893.	893.
[illegible]	[illegible]	893.	893.	893.	893.	893.	[illegible]	[illegible]	893.
[illegible]	[illegible]	[illegible]	893.	893.	893.	893.	[illegible]	[illegible]	893.
893.	[illegible]	[illegible]	893.	893.	893.	893.	[illegible]	[illegible]	893.
893.	[illegible]	[illegible]	893.	893.	893.	893.	[illegible]	[illegible]	893.
893.	[illegible]	[illegible]	[illegible]	893.	893.	894.	895.	894.	895.
895.	[illegible]	897.	894.	897.	900.	901.	902.	904.	905.
906.	907.	[illegible]	909.	910.	910.	911.	911.	911.	911.
911.	911.	911.	910.	910.	909.	909.	[illegible]	907.	907.
907.	[illegible]	906.	905.	905.	904.	904.	[illegible]	903.	903.
902.	902.	902.	902.	902.	902.	902.	902.	902.	902.
902.	902.	902.	902.	902.	903.	903.	[illegible]	905.	[illegible]
[illegible]	909.	911.	914.	916.	918.	921.	923.	927.	931.
931.	933.	[illegible]	938.	940.	942.	944.	947.	949.	953.
956.	961.	967.	973.	981.	989.	997.	1007.	1017.	1028.
1042.	1056.	1070.	1080.	1087.	1099.	1092.	1097.	1101.	1104.
1107.	1110.	1112.	1113.	1114.	1115.	1116.	1115.	1115.	1114.
1113.	1111.	1109.	1107.	1105.	1103.	1101.	1099.	1096.	1094.
1091.	1089.	1086.	1084.	1082.	1080.	1078.	1075.	1073.	1071.

STAGE

432.0	432.0	[illegible]	432.	432.0	432.0	432.0	[illegible]	432.0	[illegible]
432.0	432.0	[illegible]	432.	432.0	432.0	432.0	[illegible]	432.0	432.0
432.0	432.0	432.0	432.	432.0	432.0	432.0	[illegible]	432.0	432.0
432.0	432.0	432.0	432.	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.0	432.0	432.	432.0	432.0	432.0	432.0	432.0	432.0
432.0	432.1	[illegible]	432.	432.0	432.1	432.1	432.1	432.1	432.1
432.1	432.1	432.1	[illegible]	432.2	432.2	432.2	432.3	432.3	432.3
432.3	432.4	432.4	432.4	432.4	432.4	432.4	432.5	432.5	432.5

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
432.6	432.3	432.3	432.3	432.3	432.3	432.3	432.3	432.3	432.3
432.3	432.4	432.4	432.4	432.2	432.2	432.2	432.2	432.2	432.2
432.2	432.2	432.2	432.3	432.3	432.3	432.3	432.3	432.3	432.3
432.4	432.4	432.3	432.	432.6	432.6	432.7	432.7	432.8	432.8
432.9	433.0	433.	433.1	433.1	433.2	433.2	433.3	433.3	433.4
435.5	435.6	435.7	435.9	436.0	436.2	436.4	436.6	436.9	437.1
436.4	436.7	436.1	436.2	436.4	436.5	436.6	436.7	436.8	436.8
436.9	437.0	437.0	437.1	437.1	437.1	437.1	437.1	437.1	437.1
437.0	437.0	437.	437.7	436.9	436.8	436.8	436.7	436.7	436.6
436.5	436.5	436.4	436.4	436.3	436.3	436.2	436.2	436.1	436.1

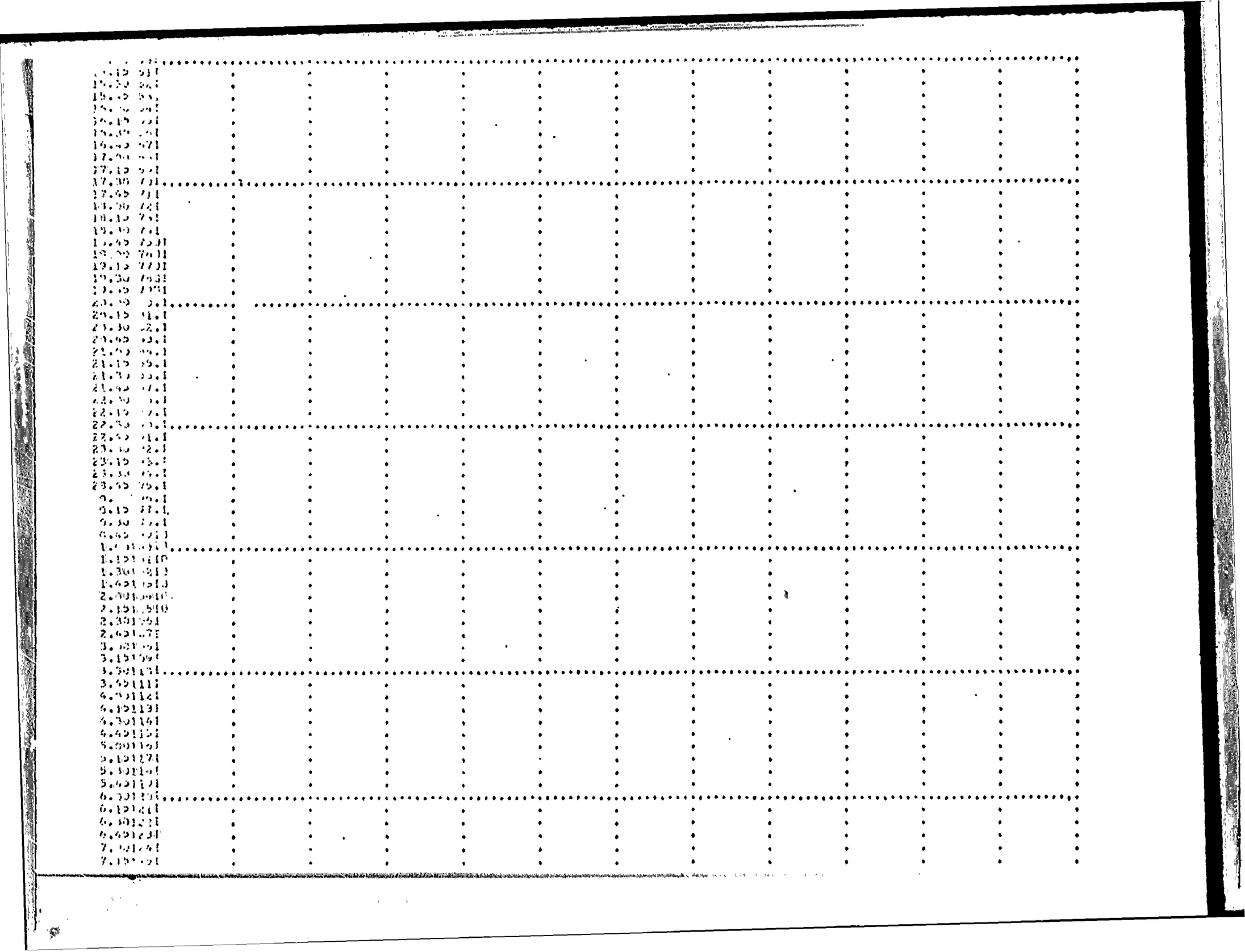
PEAK OUTFLOW IS 10457. AT TIME 44.25 HOURS

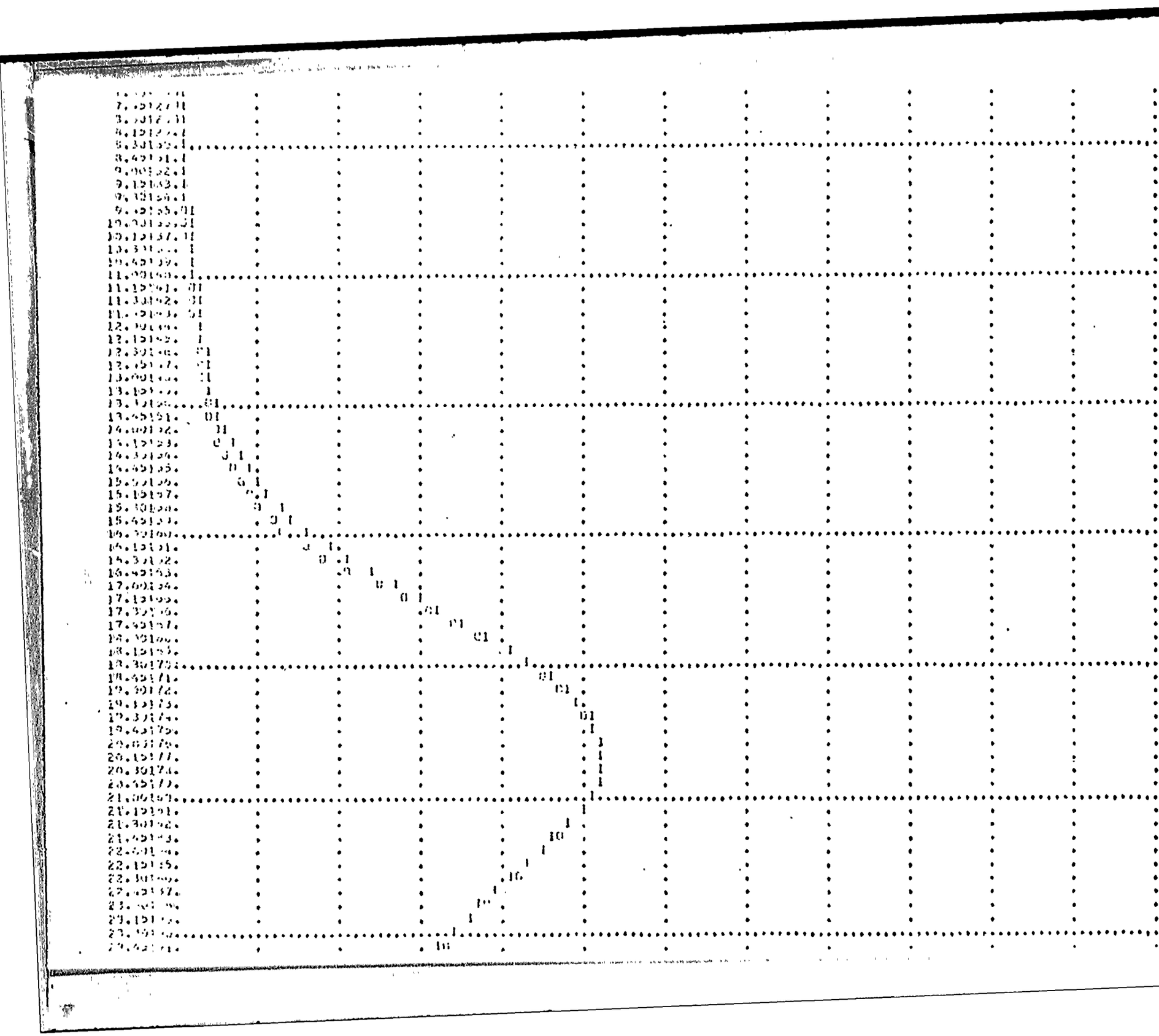
	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10457.	6947.	3344.	1629.	325749.
CMS	296.	254.	95.	46.	9226.
INCHES		11.06	16.46	16.76	16.71
MM		280.87	418.02	424.20	424.21
AC-FT		4456.	6632.	6730.	6729.
THOUS CU M		5497.	8181.	8302.	8302.

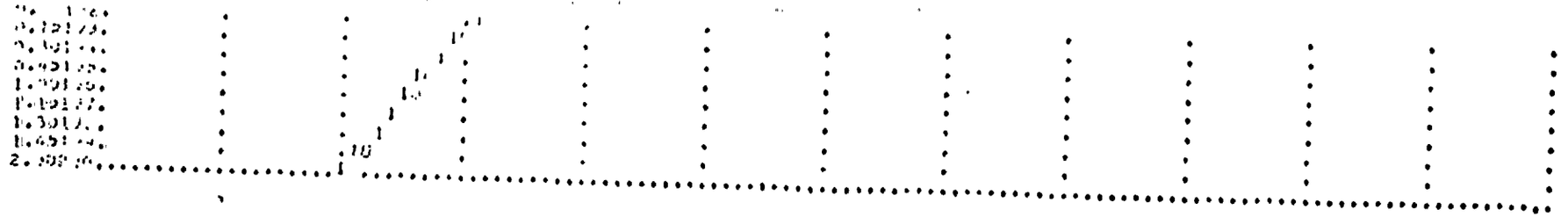
STATION 1

PLOT OF Q(I), OUTFLOW(O) AND OBSERVED FLOW(*)

		200.	400.	600.	800.	1000.	1200.	C.	C.	C.	C.	C.	C.
0.15	1												
0.30	2												
0.45	3												
1.00	4												
1.15	5												
1.30	6												
1.45	7												
2.00	8												
2.15	9												
2.30	10												
2.45	11												
3.00	12												
3.15	13												
3.30	14												
3.45	15												
4.00	16												
4.15	17												
4.30	18												
4.45	19												
5.00	20												
5.15	21												
5.30	22												
5.45	23												
6.00	24												
6.15	25												
6.30	26												
6.45	27												
7.00	28												
7.15	29												
7.30	30												
7.45	31												
8.00	32												
8.15	33												
8.30	34												
8.45	35												
9.00	36												
9.15	37												
9.30	38												
9.45	39												
10.00	40												
10.15	41												
10.30	42												
10.45	43												
11.00	44												
11.15	45												
11.30	46												
11.45	47												
12.00	48												
12.15	49												
12.30	50												
12.45	51												
13.00	52												
13.15	53												
13.30	54												
13.45	55												
14.00	56												
14.15	57												
14.30	58												
14.45	59												







PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 0.20	RATIO 2 0.40	RATIO 3 0.50	RATIO 4 0.60	RATIO 5 [illegible]	RATIO 6 1.00
				RATIOS APPLIED TO FLOWS					
HYDROGRAPH AT	1	7.00 (27.93)	1	2093. (59.2[illegible])	4187. (118.55)	5293. (149.19)	6269. (177.52)	[illegible] (237.1[illegible])	10464. (296.3[illegible])
ROUTED TO	1	7.00 (27.[illegible]3.[illegible])	1	2[illegible]. ([illegible].6[illegible])	41[illegible]1. (11[illegible].3[illegible])	5226. (14[illegible]. [illegible])	6274. (177.66)	[illegible] (2[illegible])	10457. (2[illegible].11)

PLAN 1 .....

ELEVATION STARTING OUTFLOW	INITIAL VALUE 432.00 891. 0.	SPILLWAY CREST 432.00 891. 0.	TOP OF DAM 439.00 1407. 891.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV FEET	MAXIMUM DEPTH OVER DAM FEET	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	436.09	0.	1007.	2070.	0.	94.75	0.
.40	435.66	0.18	1071.	4181.	1.75	94.50	0.
.60	435.52	0.52	1091.	5229.	4.50	94.50	0.
.80	436.56	1.50	1099.	6274.	6.00	94.50	0.
1.00	437.13	1.73	1103.	8366.	0.25	94.50	0.
1.25	437.11	1.11	1110.	10457.	0.50	94.25	0.

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

3) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

4) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX E

STABILITY ANALYSIS

46 0782

K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO MADE IN U.S.A.

INPUT FOR STABILITY ANALYSIS PROGRAM

Input Location	Input Parameter Description
0	Unit Weight of Dam (K/ft.^{3})
1	Area of Segment #1 (ft.^{2})
2	Location of Center of Gravity from toe (ft.) Segment #1
3	Area of Segment #2 (ft.^{2})
4	Location of CG from toe, Seg. #2 (ft.)
5	Area of Segment #3 (ft.^{2})
6	Location of CG from toe, Sg. #3 (ft.)
7	Total Base Width of Dam (ft.)
8	Height of Dam (ft.)
9	Ice Loading (K/L.F.)
10	Coefficient of Sliding
11	Unit Weight of Soil (K/ft.^{3})
12	Coefficient of Active Soil Pressure - Ka
13	Coefficient of Passive Soil Pressure - Kp
14	Height of Water over Top of Dam (ft.)
15	Height of Soil for Active Pressure (ft.)
16	Height of Soil for Passive Pressure (ft.)
17	Height of Water in Tailrace Channel (ft.)
18	Unit Weight of Water (K/ft.^{3})
19	Area of Segment #4 (ft.^{2})
20	Location of CG from toe, Seg. #4 (ft.)
46	Height of Ice Load or Active Water
49	Location of Foundation Drains from Heel (ft.)
50	Seismic Coefficient (α)

Browns Reservoir Dam

Slope Stability Analysis - Input Parameters

Input Location	Case I	Case II	Case III	Case IV	Case V
00	.15				
01	60				
02	13				
03	20.5				
04	9.9				
05	16.7				
06	7.6				
07	15				
08	9.8				
09	0	5	0	0	0
10	.7				
11	06				
12	.249				
13	2.1				
14	0	0	4.3	5.1	0
15	9.8				
16	5.9				
17	0	0	4.3	5.1	0
18	.0624				
19	29.4				
20	3.3				
46	9.8				
50	0	0	0	0	0.1

BROWNS RESERVOIR DAM
STABILITY ANALYSIS
SPILLWAY SECTION

Case I Normal Loading

(a) 3.195850943

(b) 8.84157393

(c) 3.305028559

Case II Ice Loading

(a) 1.732275324

(b) 5.439644324

(c) 1.408737339

Case III 1/2 PMF

(a) 2.300[illegible]535

(b) 8.492[illegible]382

(c) 1.804[illegible]39[illegible]

Case IV PMF

(a) 2.191015294

(b) 8.447680312

(c) 1.670850058

Case V Seismic Loading

(a) 2.394594755

(b) 7.494274558

(c) 2.064795441

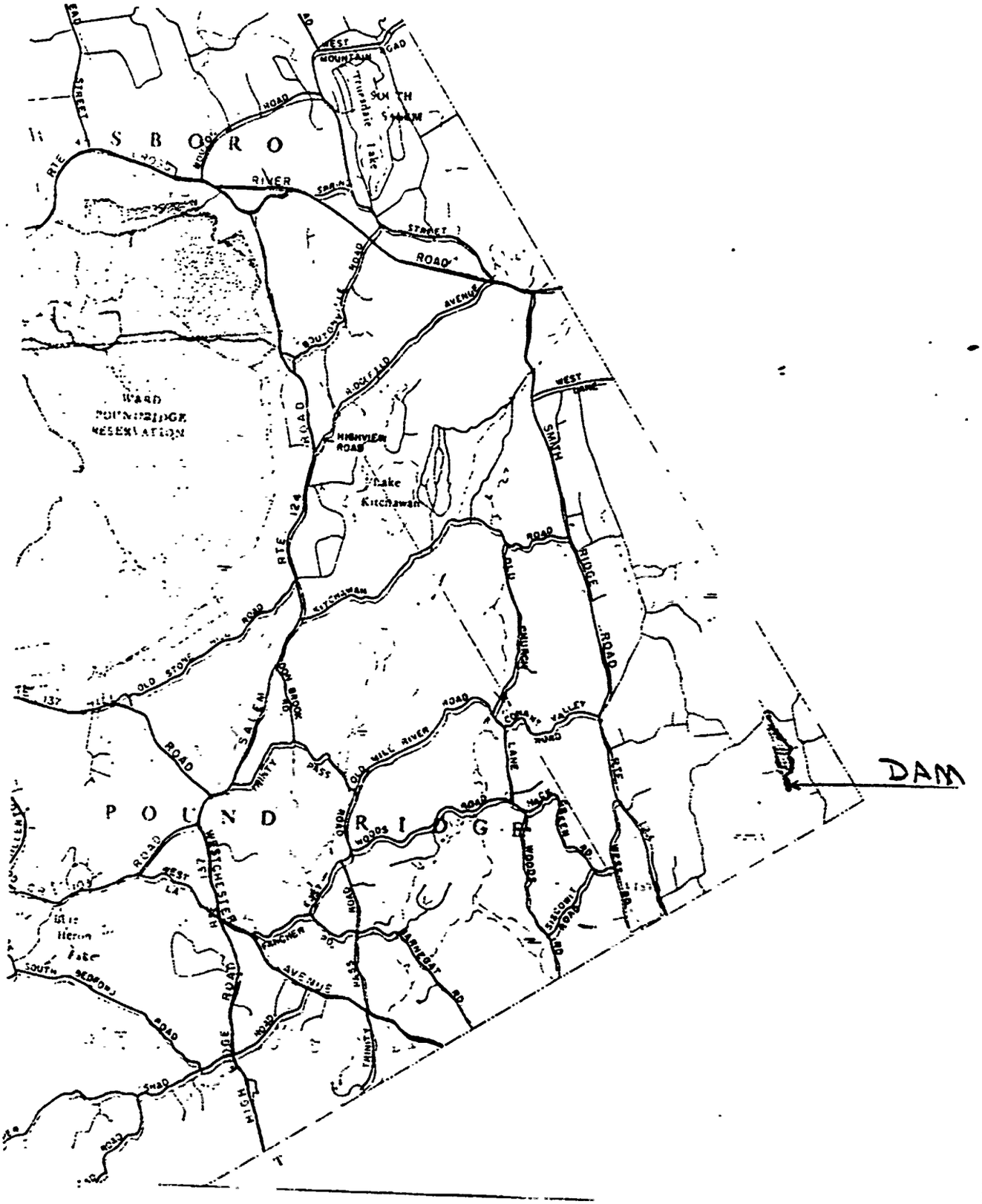
NOTE: (a) is the factor of safety for overturning;

(b) is the location of the resultant from the toe;

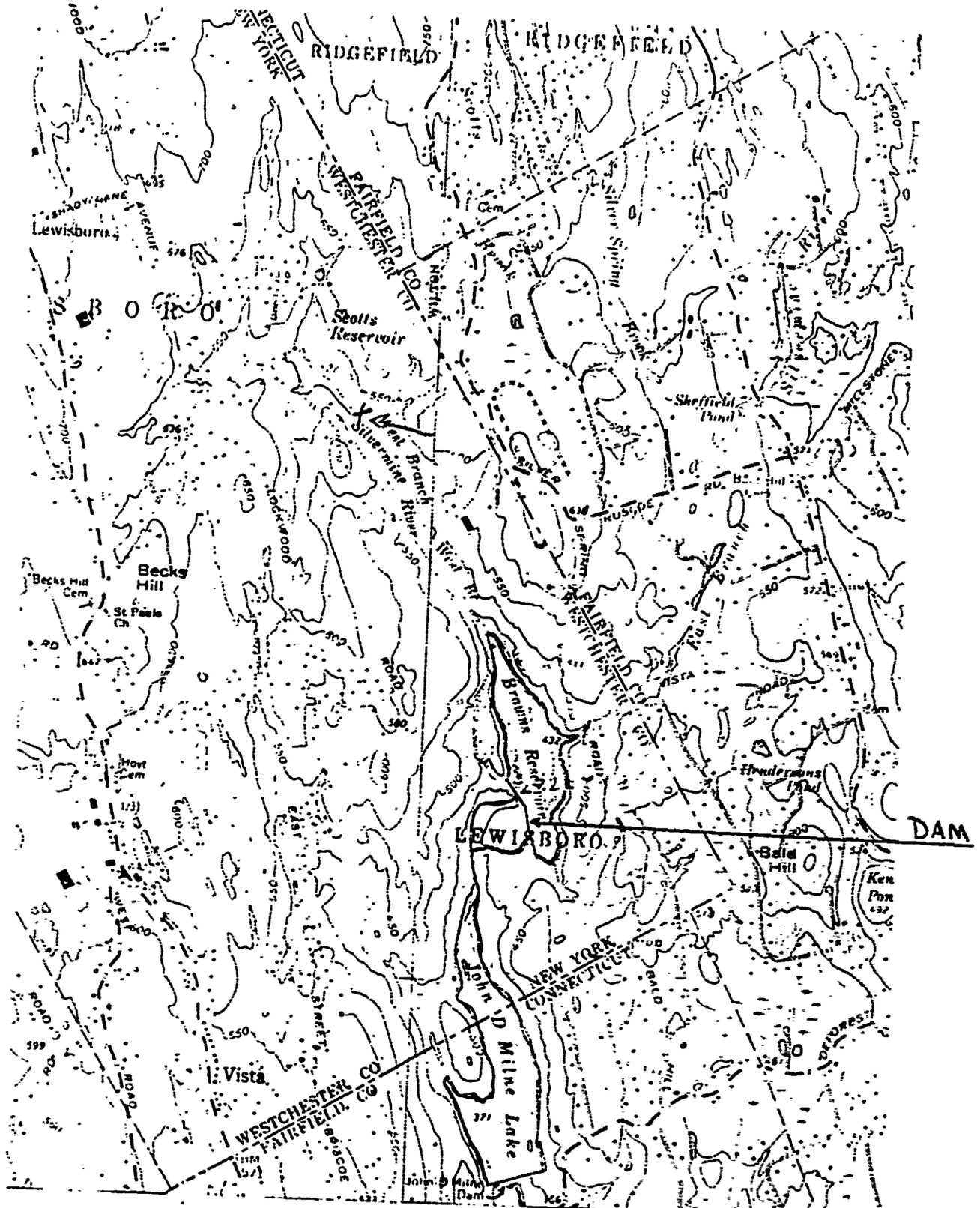
(c) is the factor of safety for sliding.

APPENDIX F

DRAWINGS



VICINITY MAP

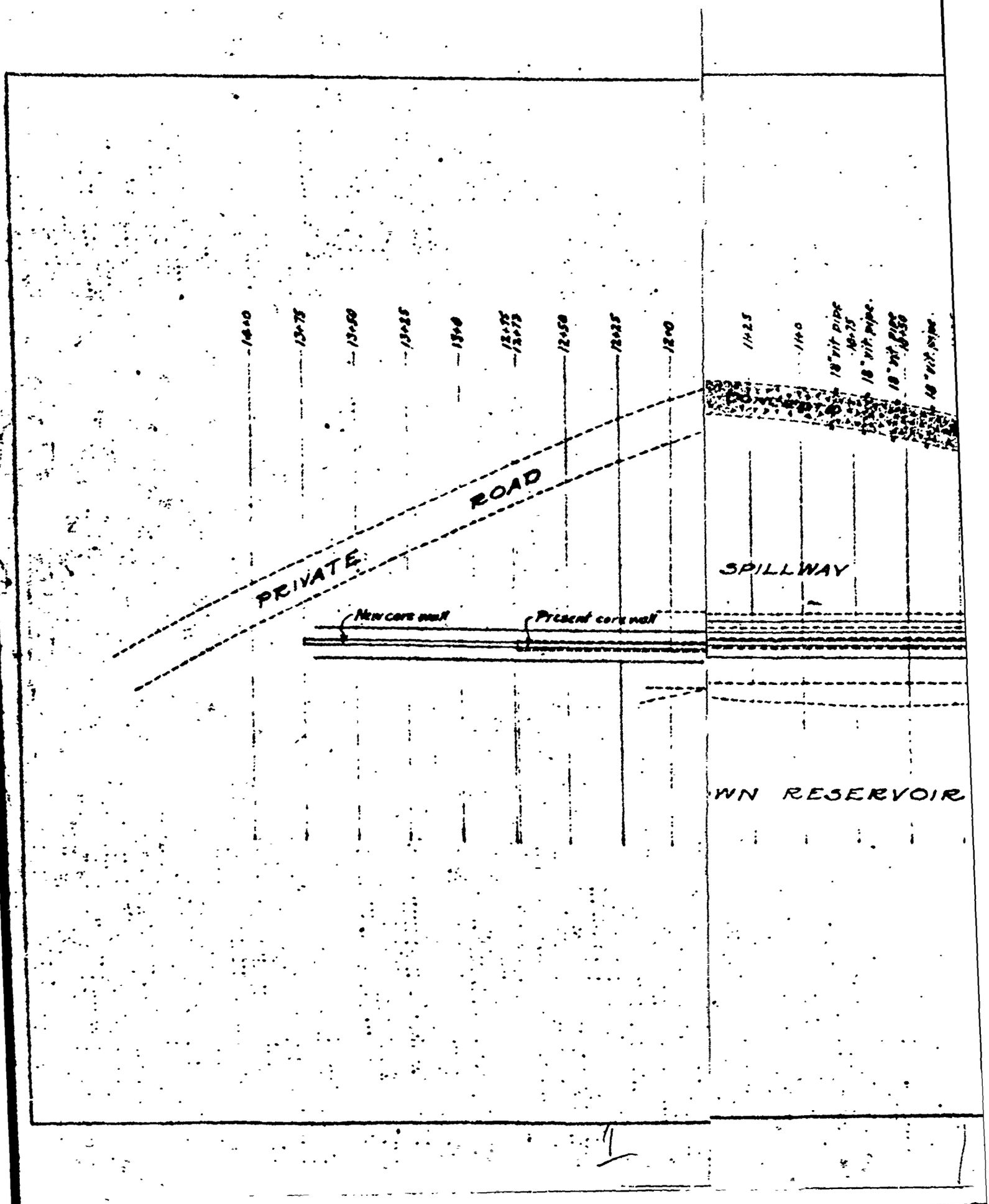


TOPOGRAPHIC MAP

BROWNS RESERVOIR DAM

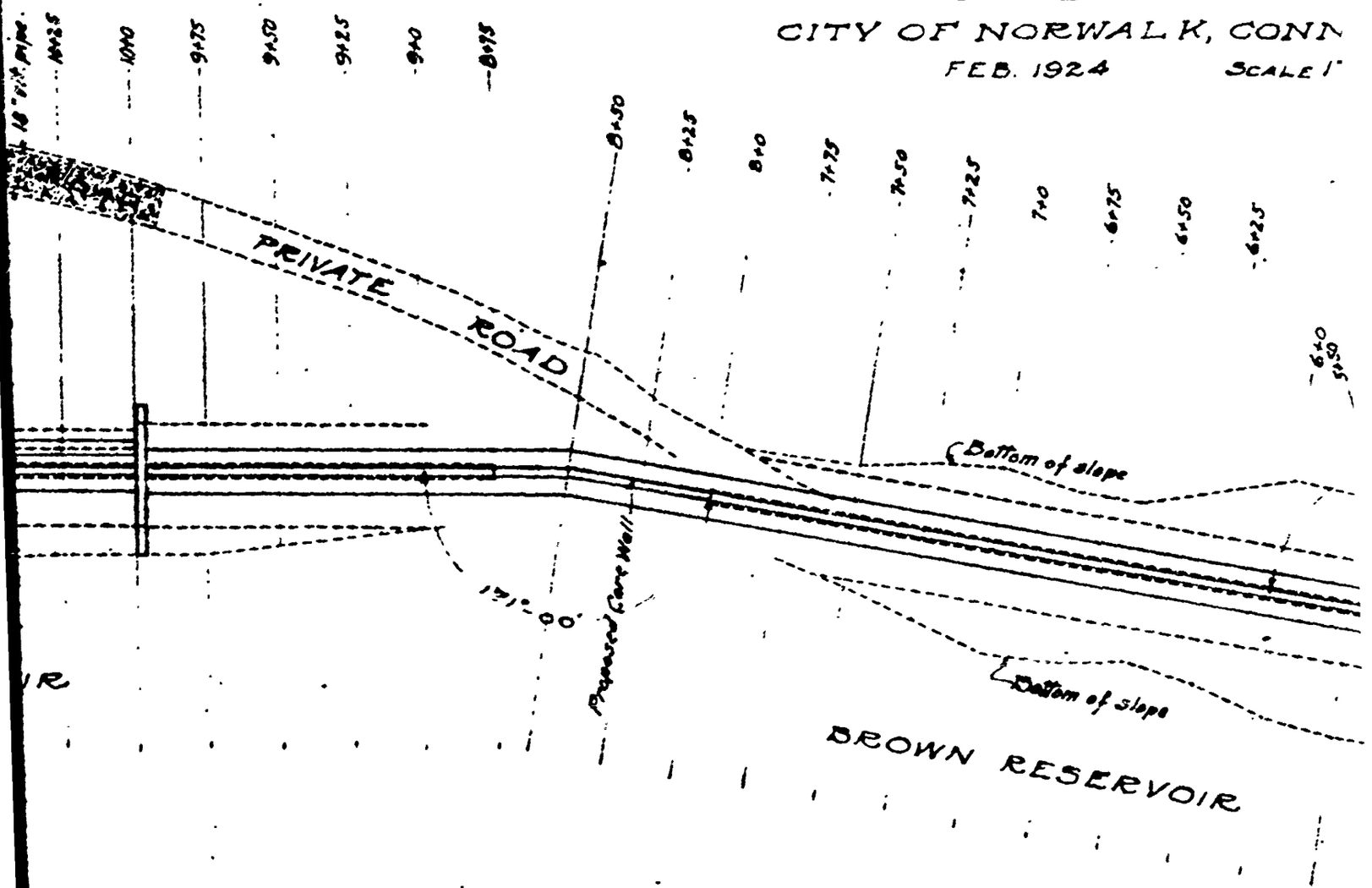
LIST OF DRAWINGS

DESCRIPTION	DRAWING NUMBER
GENERAL PLAN	—
GATE CHAMBER and PIPE PLAN (1909)	Sheet No 7
GATE CHAMBER and PARAPET WALL DETAIL PLAN (1909)	Sheet No 8
PLAN (1924)	1
SECTIONS (1924)	2
SPILLWAY & GATEHOUSE WALL (1924)	3
SECTIONS (1924)	4


1+40
13+75
13+50
13+25
13+0
12+75
12+73
12+50
12+25
12+0
1+25
1+0
18" vit. pipe
18" vit. pipe.
18" vit. pipe.
18" vit. pipe.
PRIVATE ROAD
SPILLWAY
New core wall
Present core wall
WN RESERVOIR

PLANS AND DETAILS
OF PROPOSED WORK AT
BROWN RESERVOIR
FOR THE
FIRST TAXING DISTRI(
OF THE
CITY OF NORWALK, CONN
FEB. 1924 SCALE 1"

District Commissioners
John D. Milne
Edward J. Finnegan
Wallace Dann.



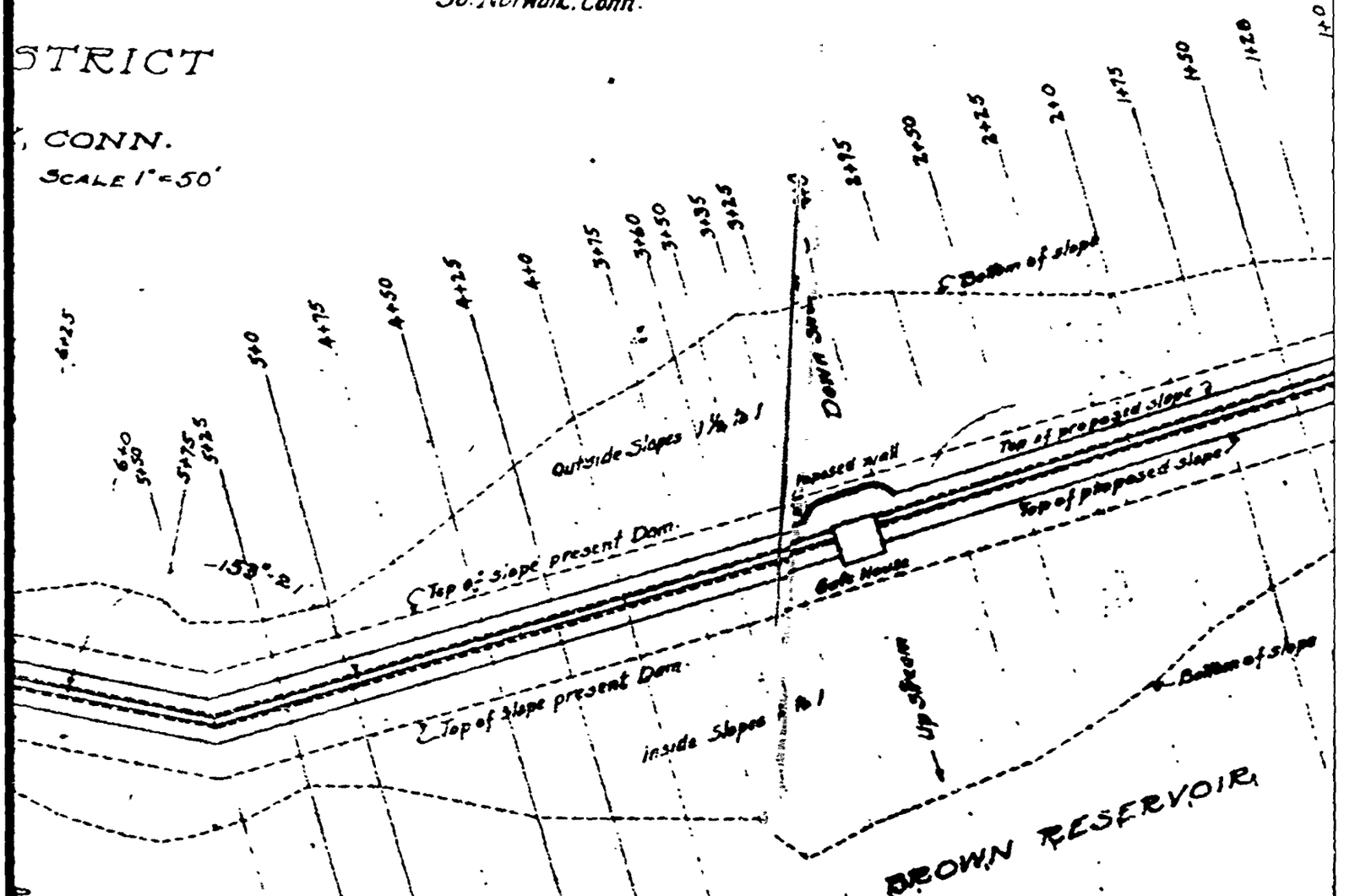
2

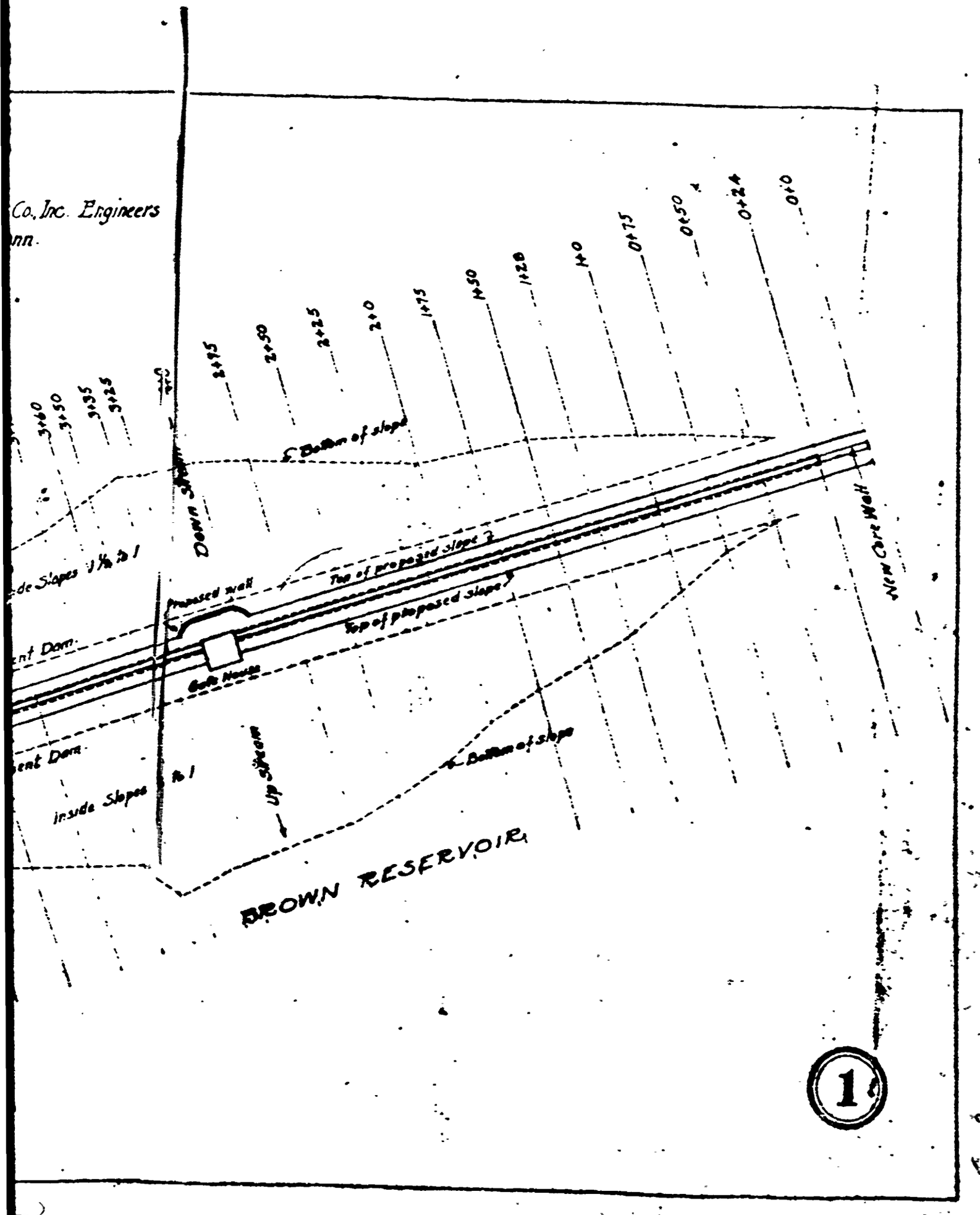
TAILS
AT
VOIR

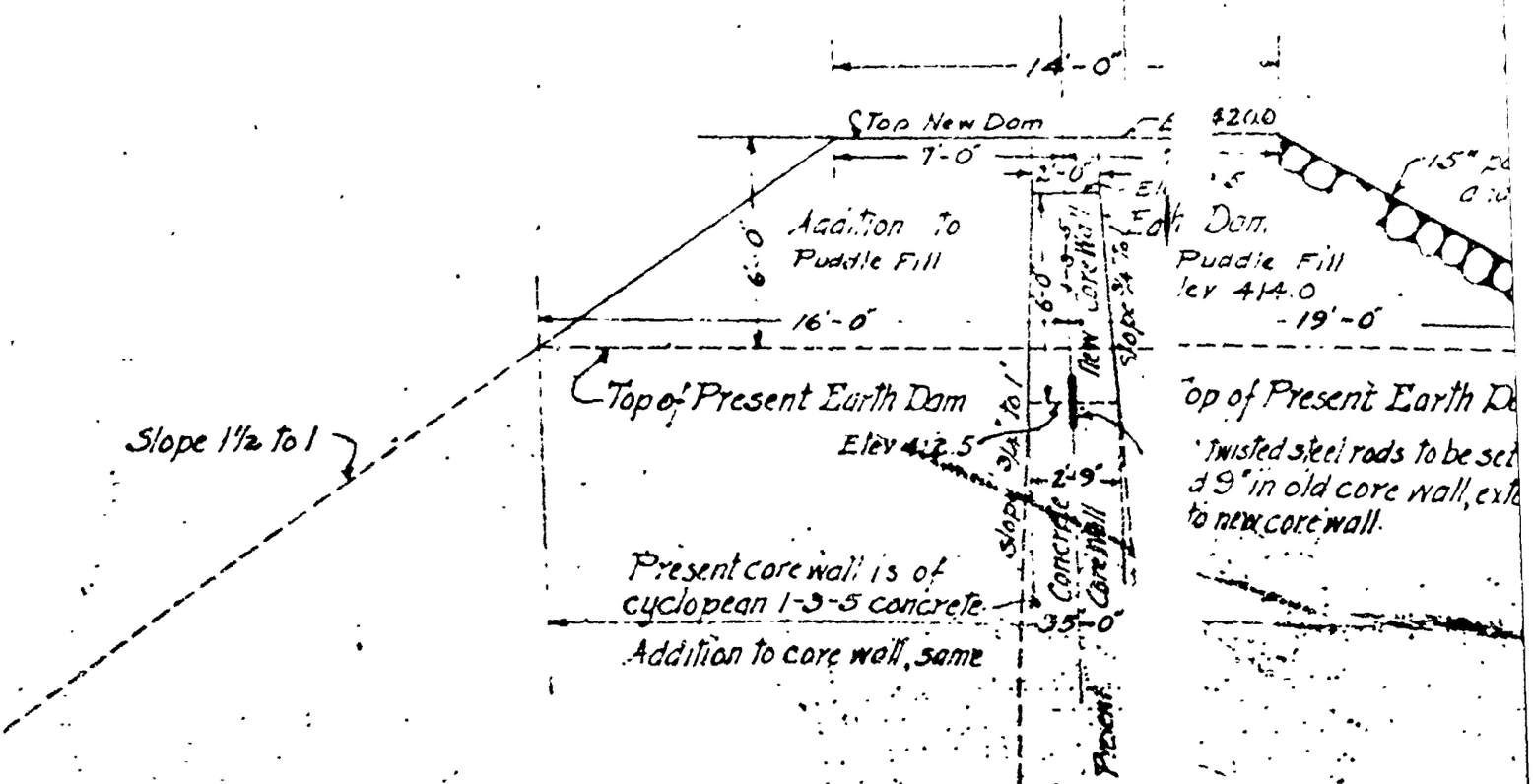
STRICT

, CONN.
SCALE 1"=50'

The Samuel W. Hoyt, Co., Inc. Engineers
So. Norwalk, Conn.




Co., Inc. Engineers
nn.
3+60
3+50
3+35
3+25
3+15
2+50
2+25
2+0
1+75
1+50
1+28
1+0
0+75
0+50
0+24
0+0
℄ Bottom of slope
Down Stream
de Slopes 1½ to 1
Proposed wall
Top of proposed slope
Top of proposed slope
ent Dam
Gate House
ent Dam
Inside Slopes to 1
Up Stream
℄ Bottom of slope
New Park Road
BROWN RESERVOIR
1



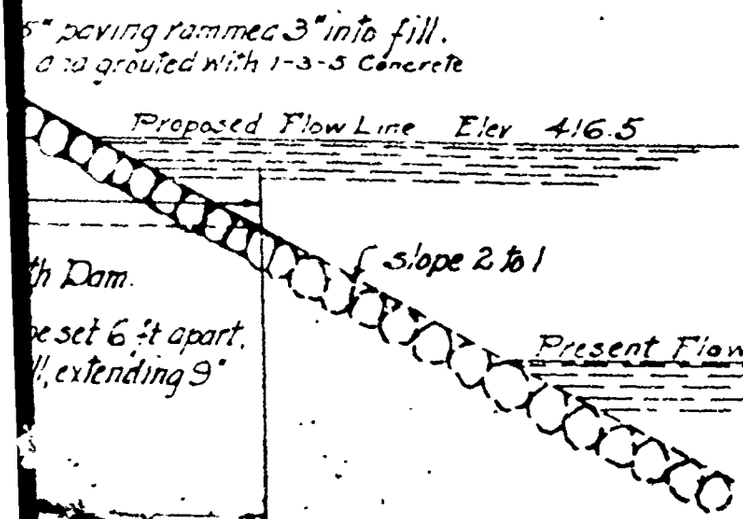
SECTION THRU ESENT
SHOWING ITIONS

SCALE

~ Notice ~

After completing these plans it was decided to substitute common embankment for puddle fill on the down stream side of core wall and to also substitute sand and gravel joints for cement grout in paving work on up stream slope of dam.

~ District
John D
Edward
Wallace



PLANS AND DETAILS

OF PROPOSED WORK AT

DAM

BROWN RESERVOIR

FOR THE

FIRST TAXING DISTRICT

OF THE

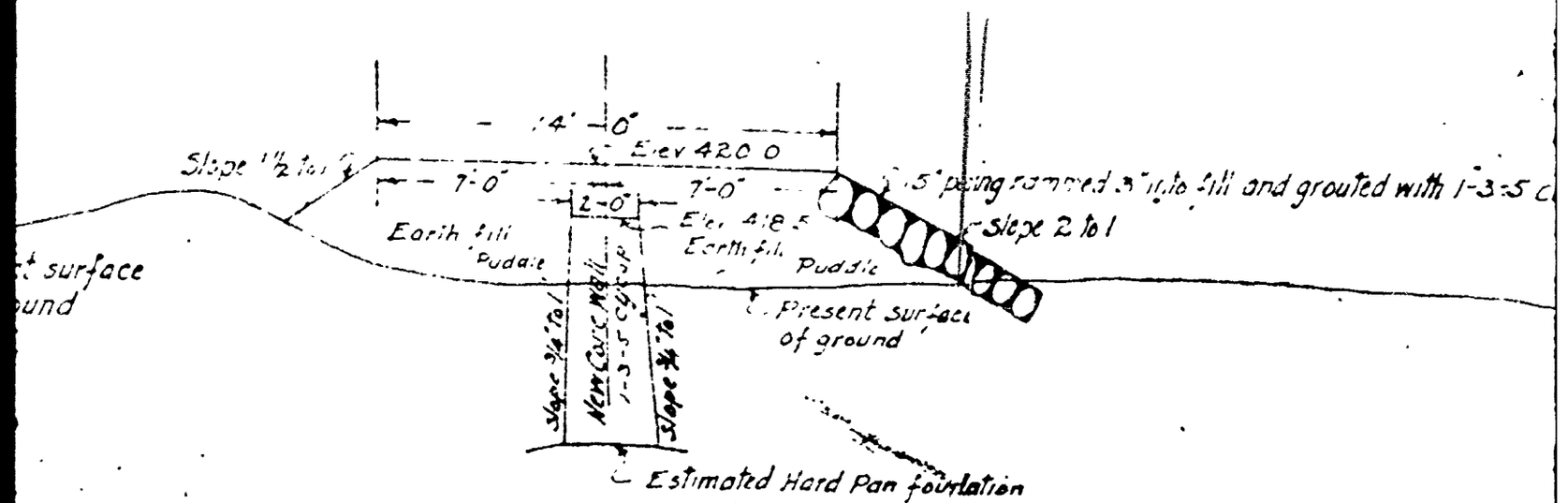
CITY OF NORWALK, CONN.

trict Commissioners
n D. Milne
ward J. Finnegan
lace Dann.

SCALES
as noted

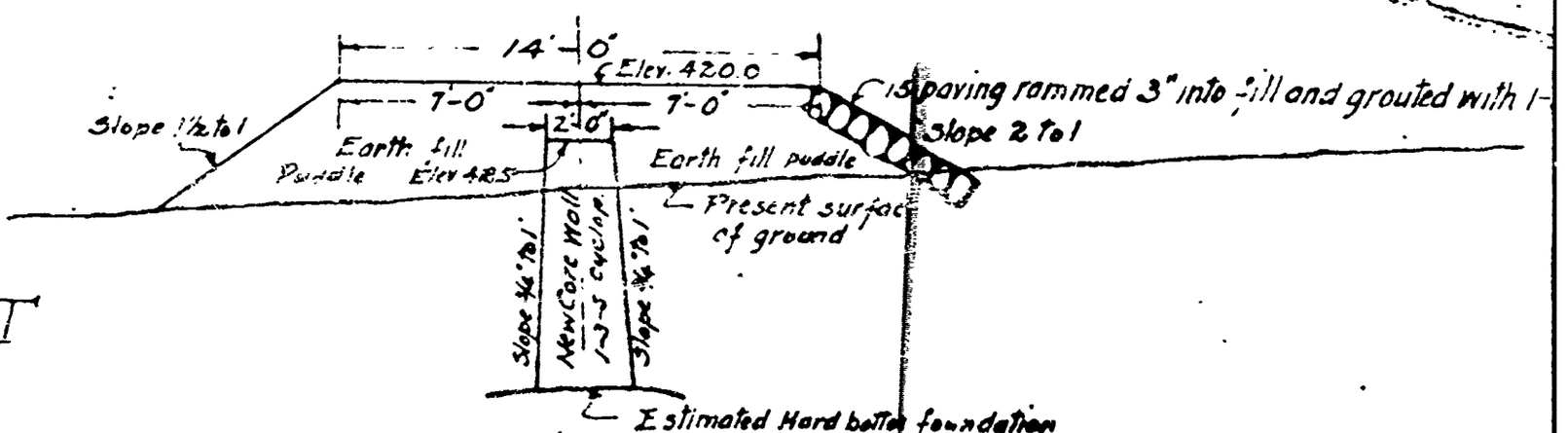
FEB. 1924.

The Samuel W Hoyt. Jr.,
Engineers.



SECTION THRU STA. 8+25 SCALE 1"=5'

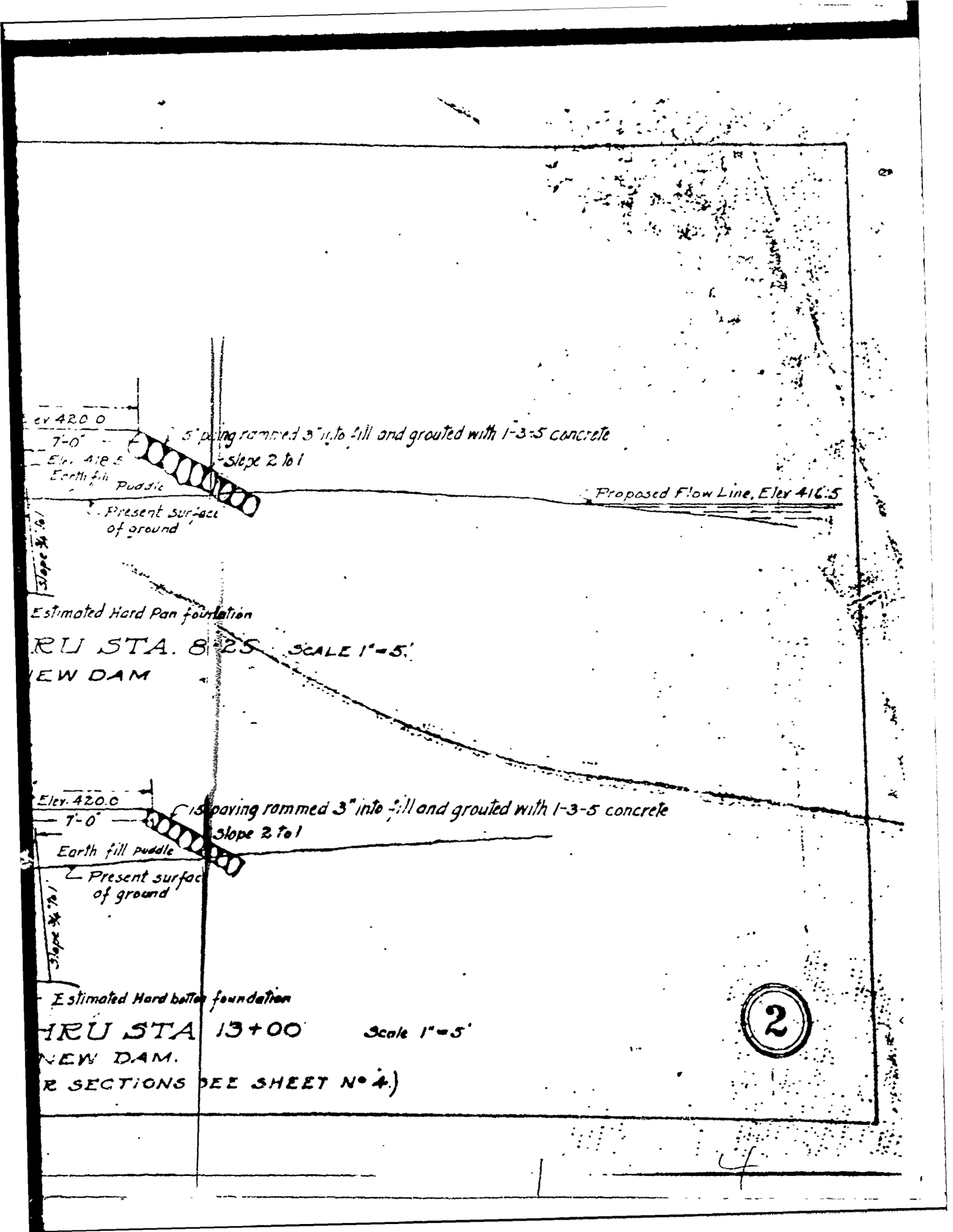
SHOWING NEW DAM

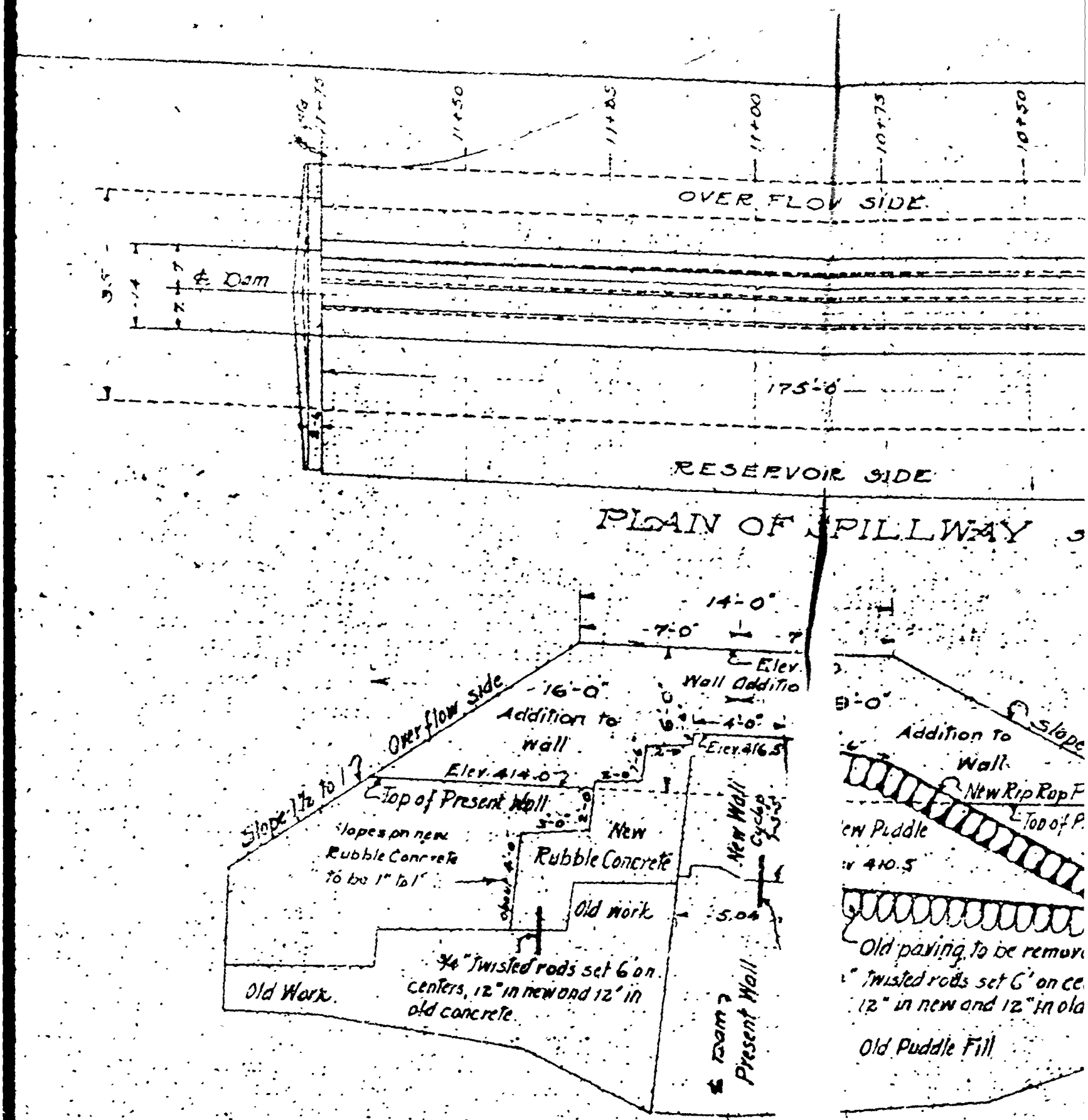


SECTION THRU STA 13+00 Scale 1"=5'

SHOWING NEW DAM.

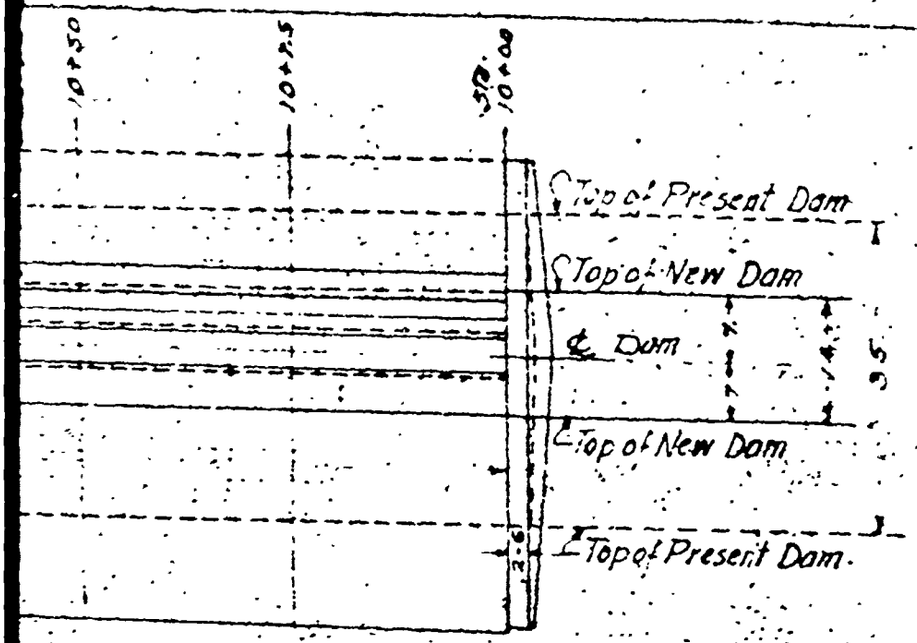
(FOR OTHER SECTIONS SEE SHEET NO 4.)


ev 420.0
7-0"
Elev. 416.5
Earth fill
Puddle
5" paving rammed 3" into fill and grouted with 1-3-5 concrete
Slope 2 to 1
Present surface of ground
Proposed Flow Line, Elev 416.5
Slope 2 to 1
Estimated Hard Pan foundation
RU STA. 8+25 SCALE 1"=5'
EW DAM
Elev. 420.0
7-0"
5" paving rammed 3" into fill and grouted with 1-3-5 concrete
Slope 2 to 1
Earth fill puddle
Present surface of ground
Slope 2 to 1
Estimated Hard batter foundation
HRU STA 13+00 Scale 1"=5'
NEW DAM.
R SECTIONS SEE SHEET N° 4.)
2



PLAN OF SPILLWAY

SECTION OF PILLWAY
AT NORTH WING WALL



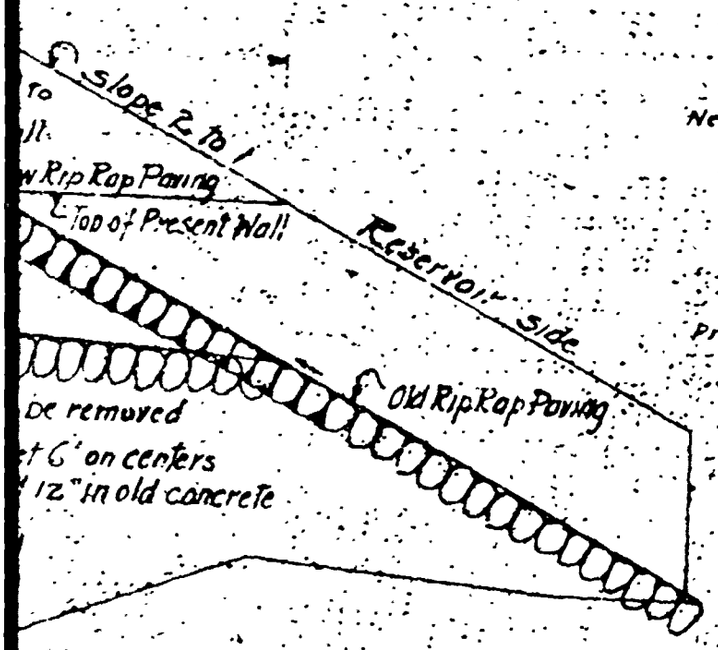
AY SCALE 1"=20'

PLAN AND DETAILS
OF PROPOSED WORK AT
BROWN RESERVOIR
FOR THE
FIRST TAXING DISTRIC
OF THE
CITY OF NORWALK, C
FEB 1924

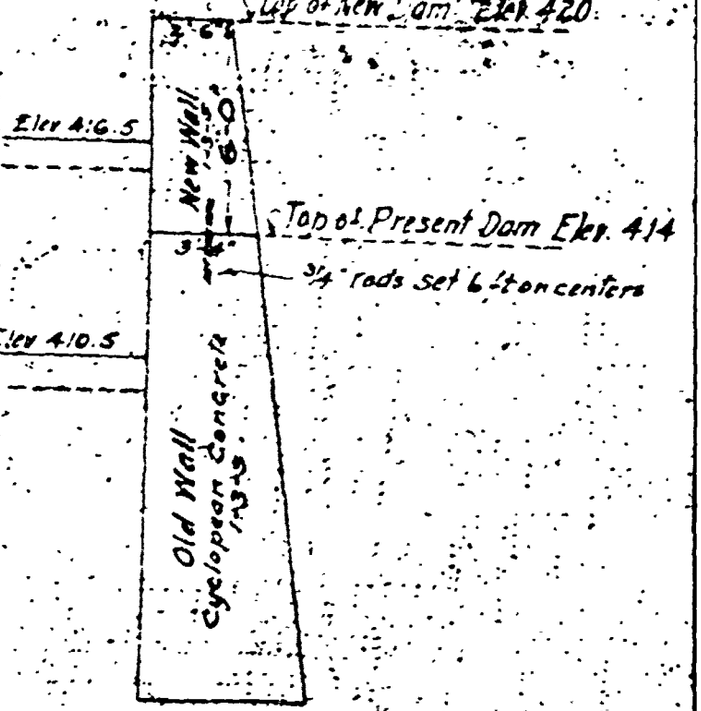
SCALES as noted

The Samuel W Hoyt
E

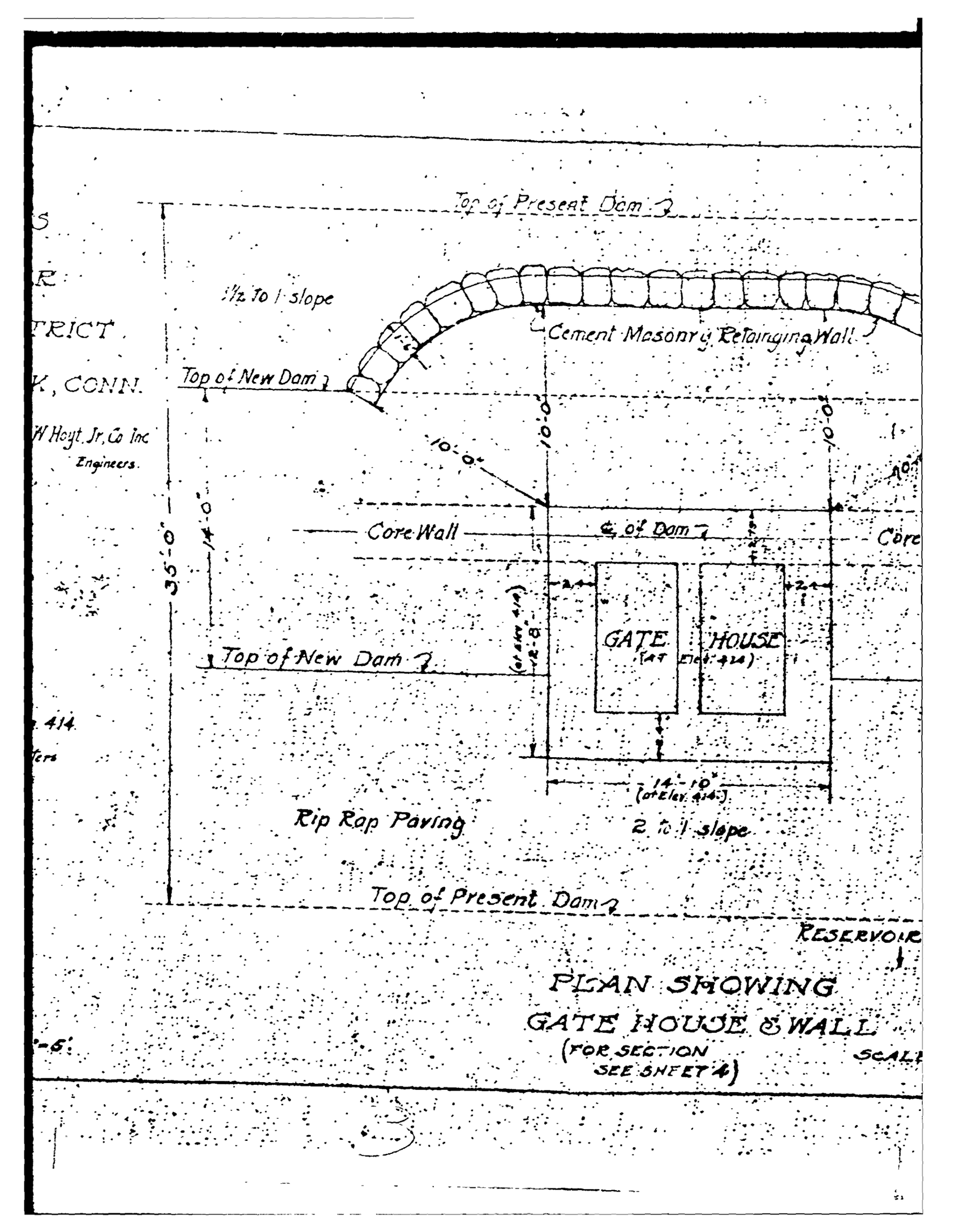
District Commissioners
Jean D. Milne
Edward J. Finnegan
Wallace Dann.

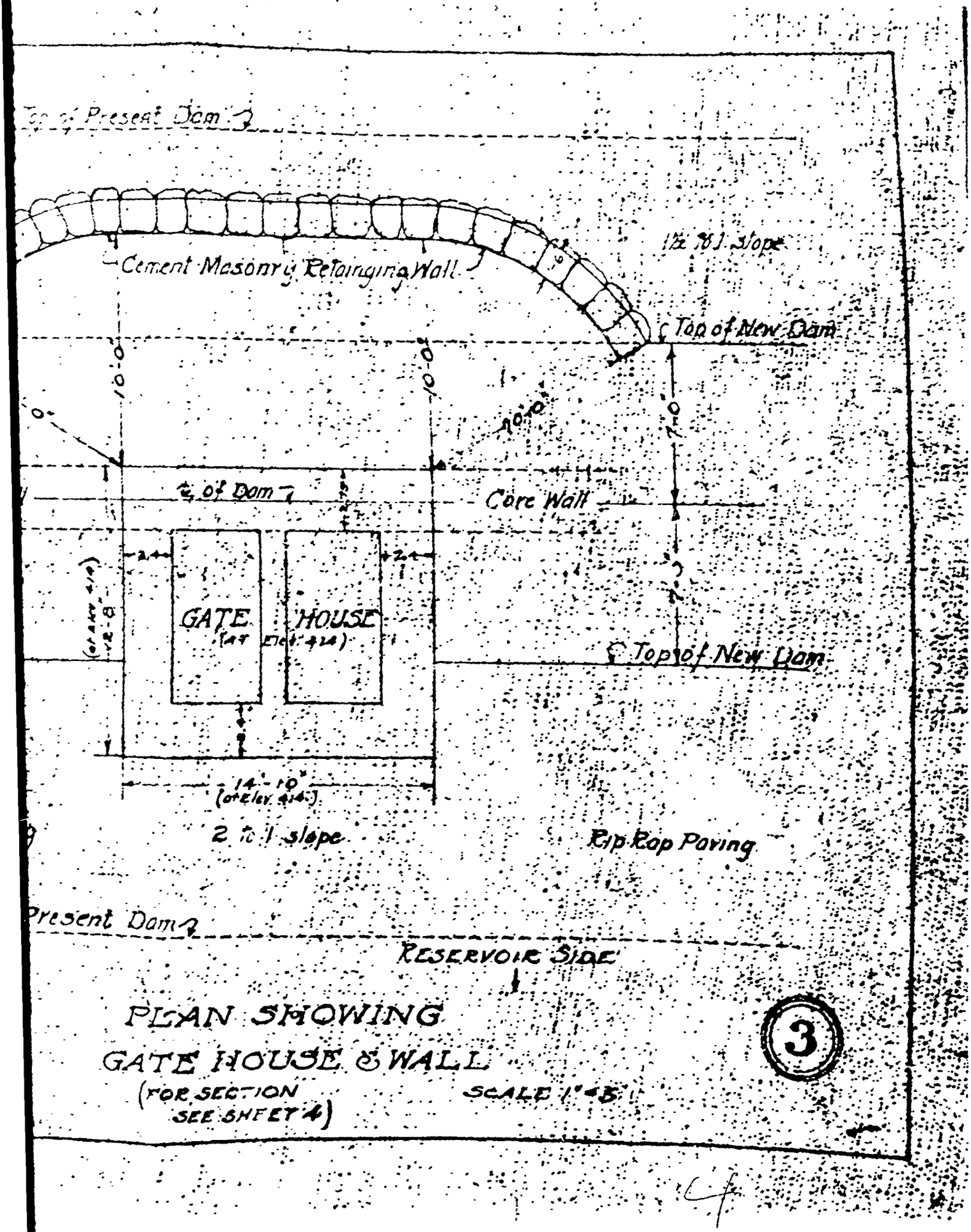


AY SCALE 1"=5'



SECTION OF WINGWALL
THRU ℄ OF DAM SCALE 1"=5'

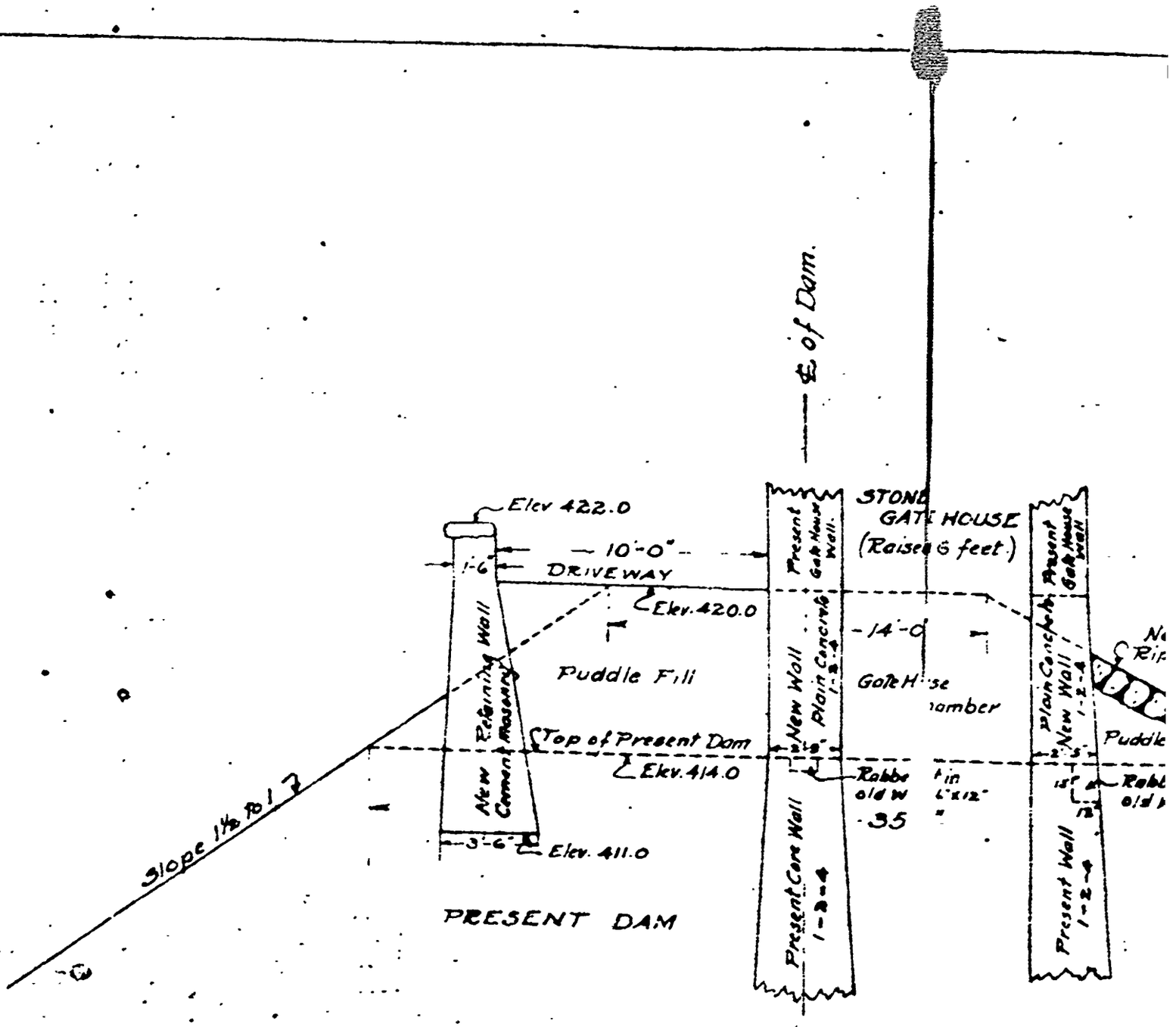

Top of Present Dam
1½ to 1 slope
Cement Masonry Retaining Wall
Top of New Dam
10'-0"
10'-0"
10'-0"
Core Wall
℄ of Dam
Core
35'-0"
14'-0"
GATE HOUSE
(at Elev. 414)
Top of New Dam
(at elev. 414)
12'-8"
14'-10"
(at elev. 414.)
Rip Rap Paving
2 to 1 slope
Top of Present Dam
RESERVOIR
PLAN SHOWING
GATE HOUSE & WALL
(FOR SECTION
SEE SHEET 4)
SCALE
W Hoyt Jr, Co Inc
Engineers.
K, CONN.
TRICT
R
S
414
fers
-6"



PLAN SHOWING
GATE HOUSE & WALL
(FOR SECTION SEE SHEET 4)

SCALE 1" = 5'

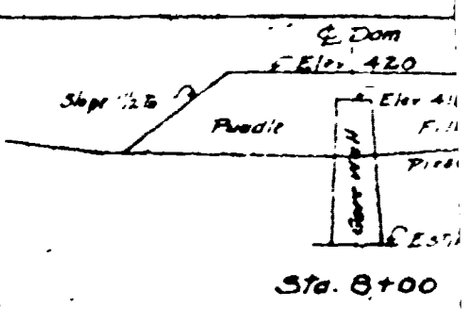
3



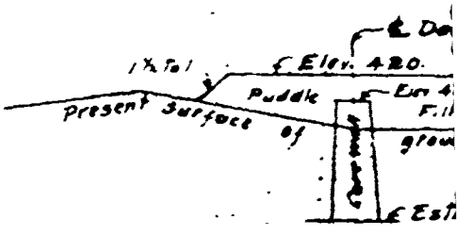
SECTION F DAM

THRU CENTER OF GAT

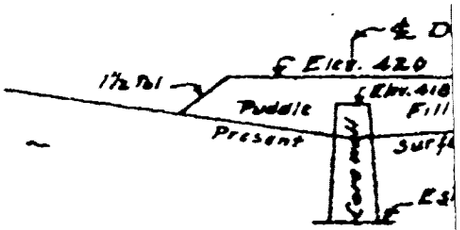
SCA



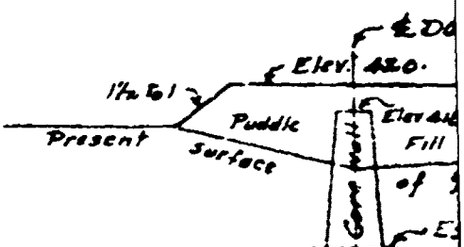
Sta. 8+00



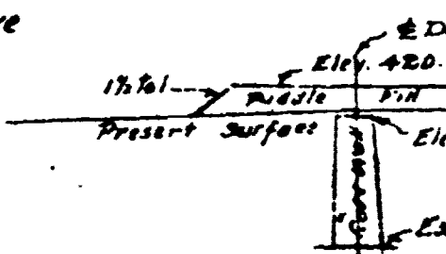
Sta. 8+25



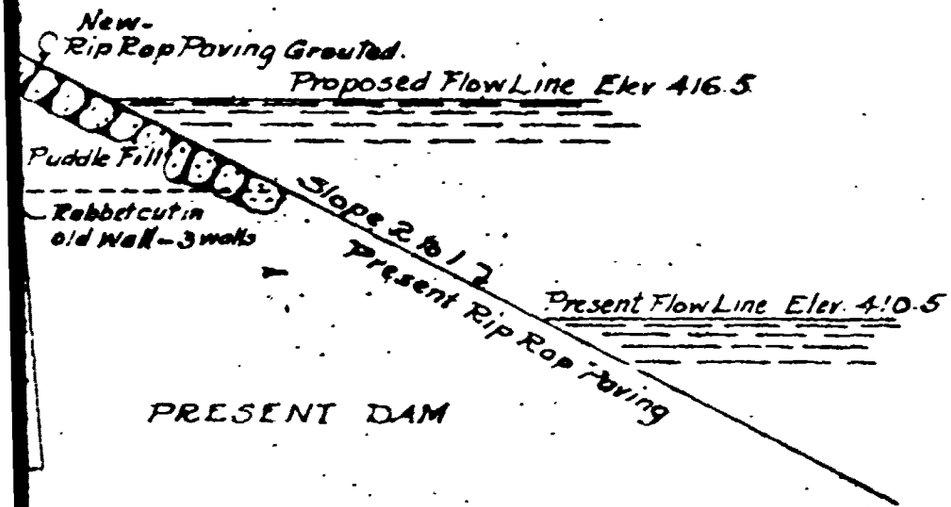
Sta. 8+50



Sta. 8+7



Sta 12+79

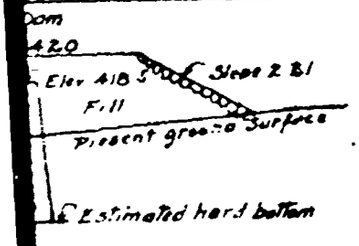


ATE HOUSE

SCALE 1"=5'

– Notice –

After completing these plans it was decided to substitute common embankment for puddle fill on the down stream side of core wall and to also substitute sand and gravel joints for cement grout in paving work on up stream slope of dam.



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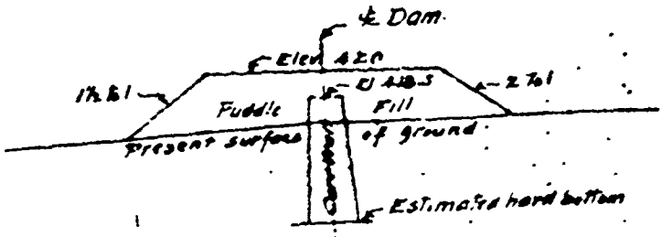
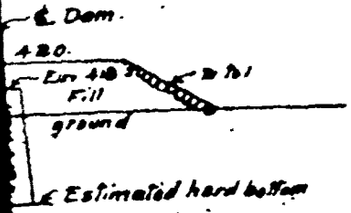


Sta. 13+00



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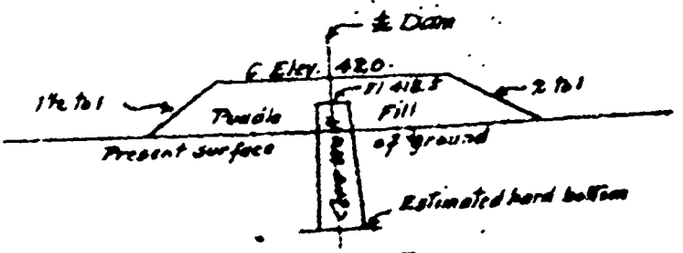

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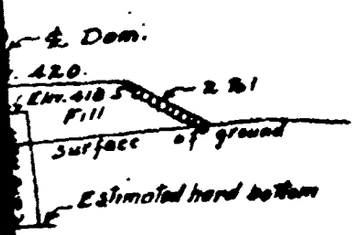
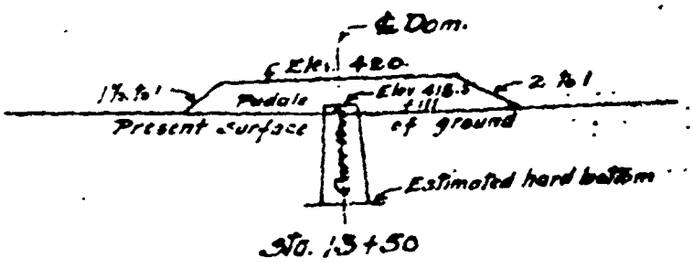


8+50



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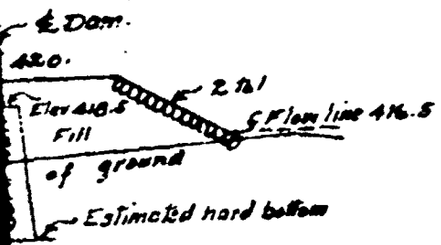
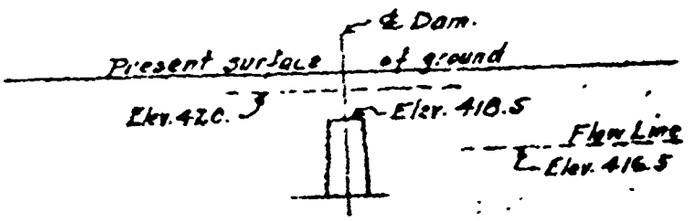


8+75



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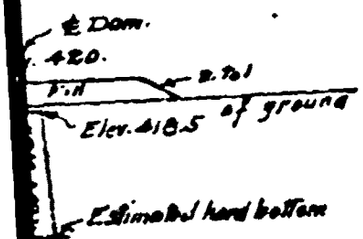


+73

PLA

O

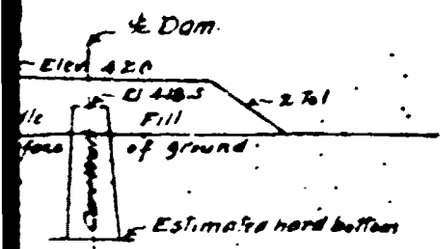
BROW

FIRST T2

CITY OF

SCALES.
as noted

SECTIONS OF NEW WORK
SCALE 1"=10'



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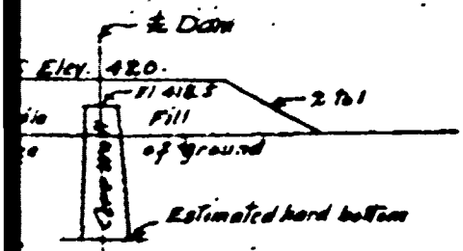

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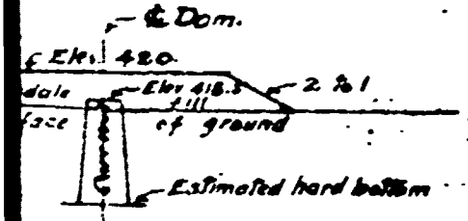

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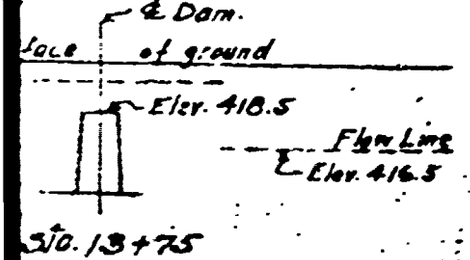


Sta. 13+75

ONS OF NEW WORK

SCALE 1"=10'

PLANS AND DETAILS

OF PROPOSED WORK AT

BROWN RESERVOIR

FOR THE

FIRST TAXING DISTRICT

OF THE

CITY OF NORWALK, CONN.

FEB. 1924.

SCALES

as noted

The Samuel M. Lloyd Jr. Co. Inc.

Engineers.

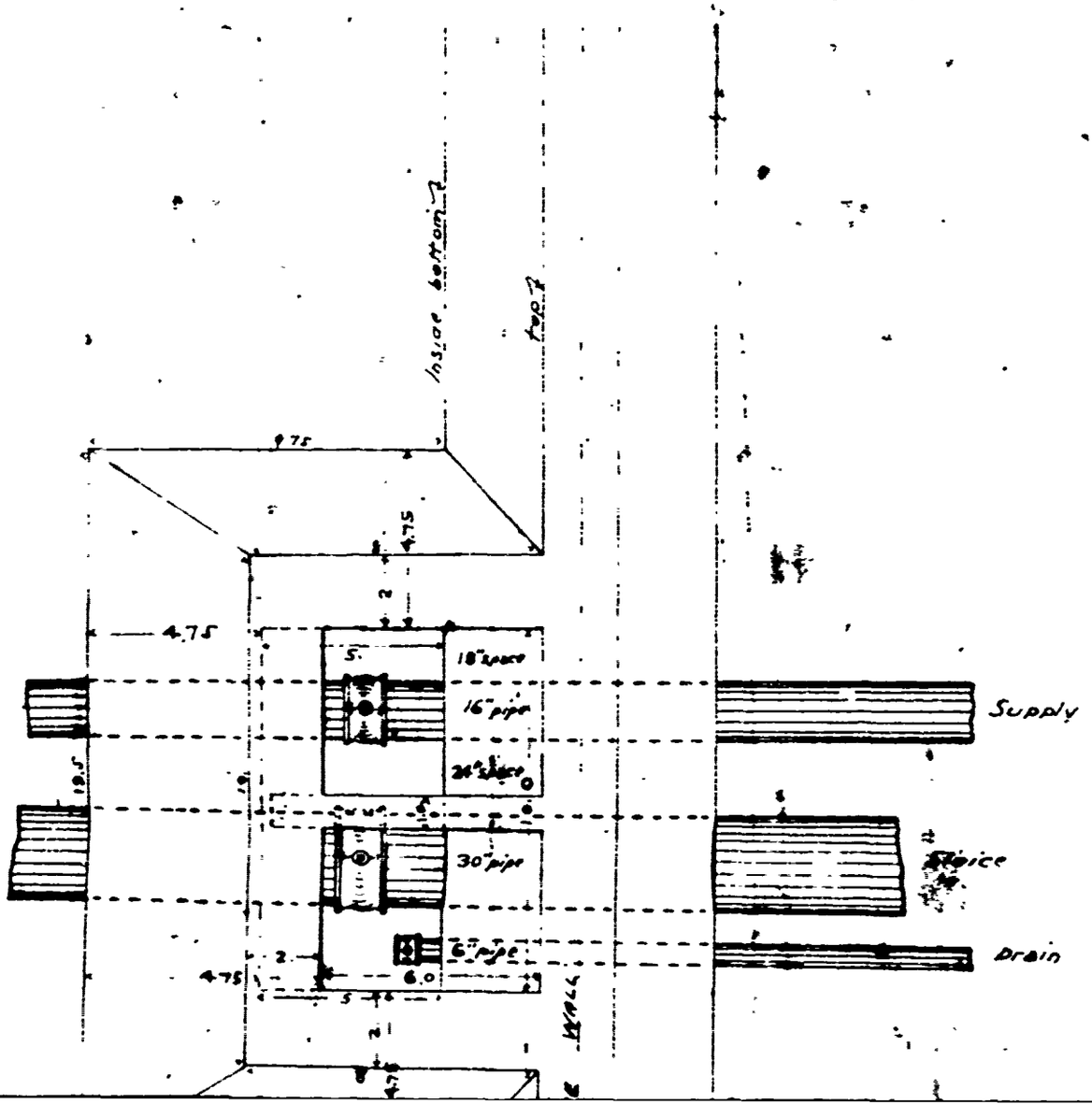
District Commissioners

John D. Milne

Edward J. Finnegan

Wallace Dann.

4


Inside bottom
Top
9.75
4.75
2
4.75
5
18" pipe
16" pipe
24" pipe
18.5
30" pipe
6" pipe
4.75
6.0
5
2
Supply
Drain

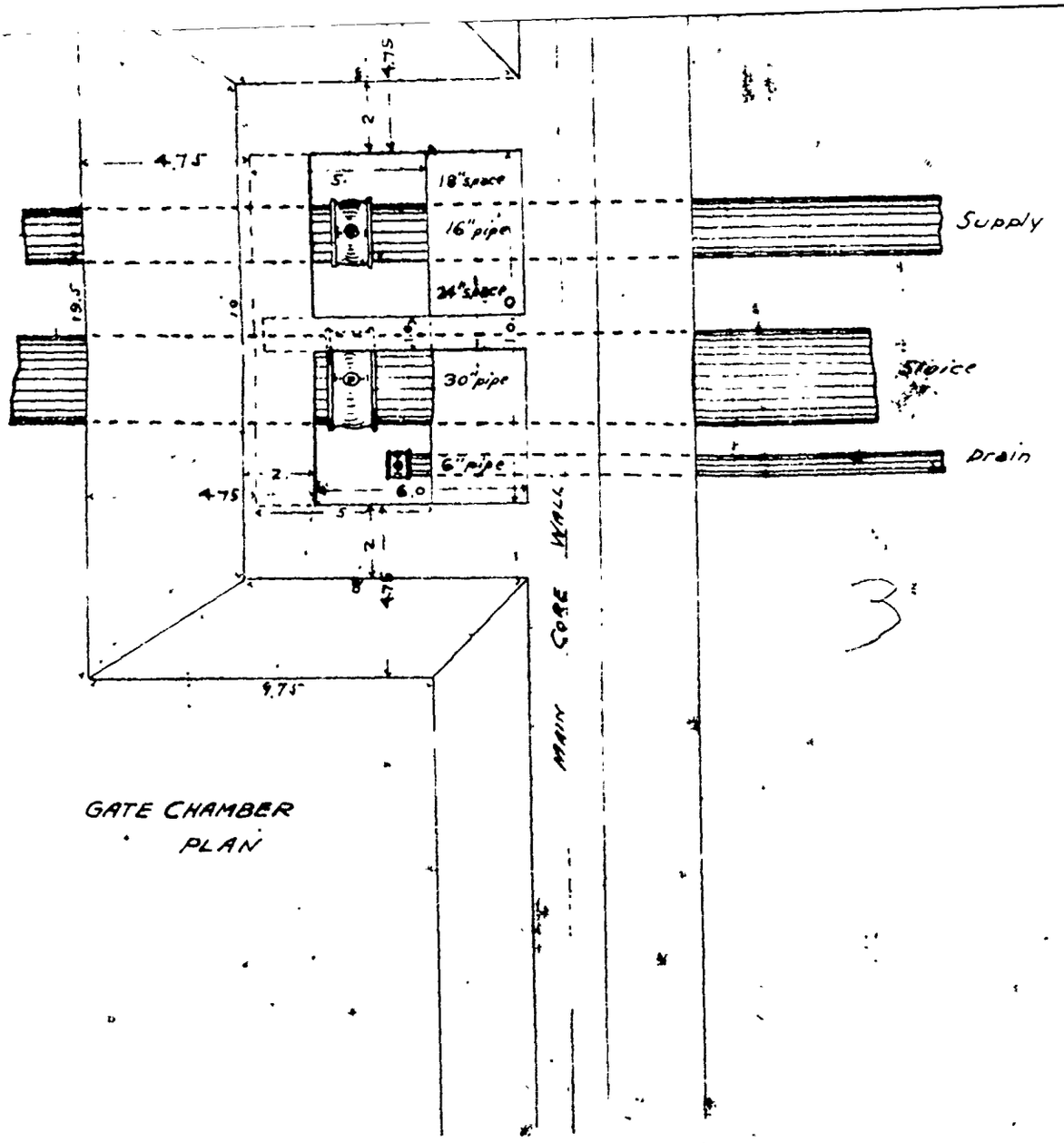
SHEET No. EIGHT

GATE CHAMBER AND PA[illegible]

SCALE ONE INCH = FOUR FEET

C.N. WOOD C.E.

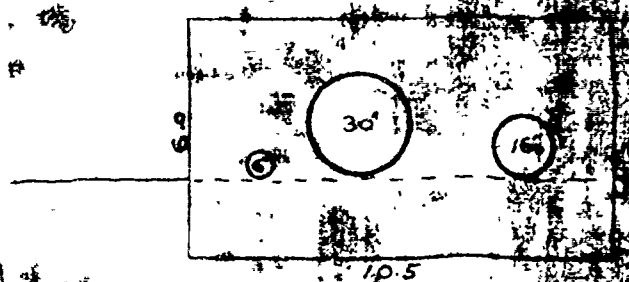
1909.



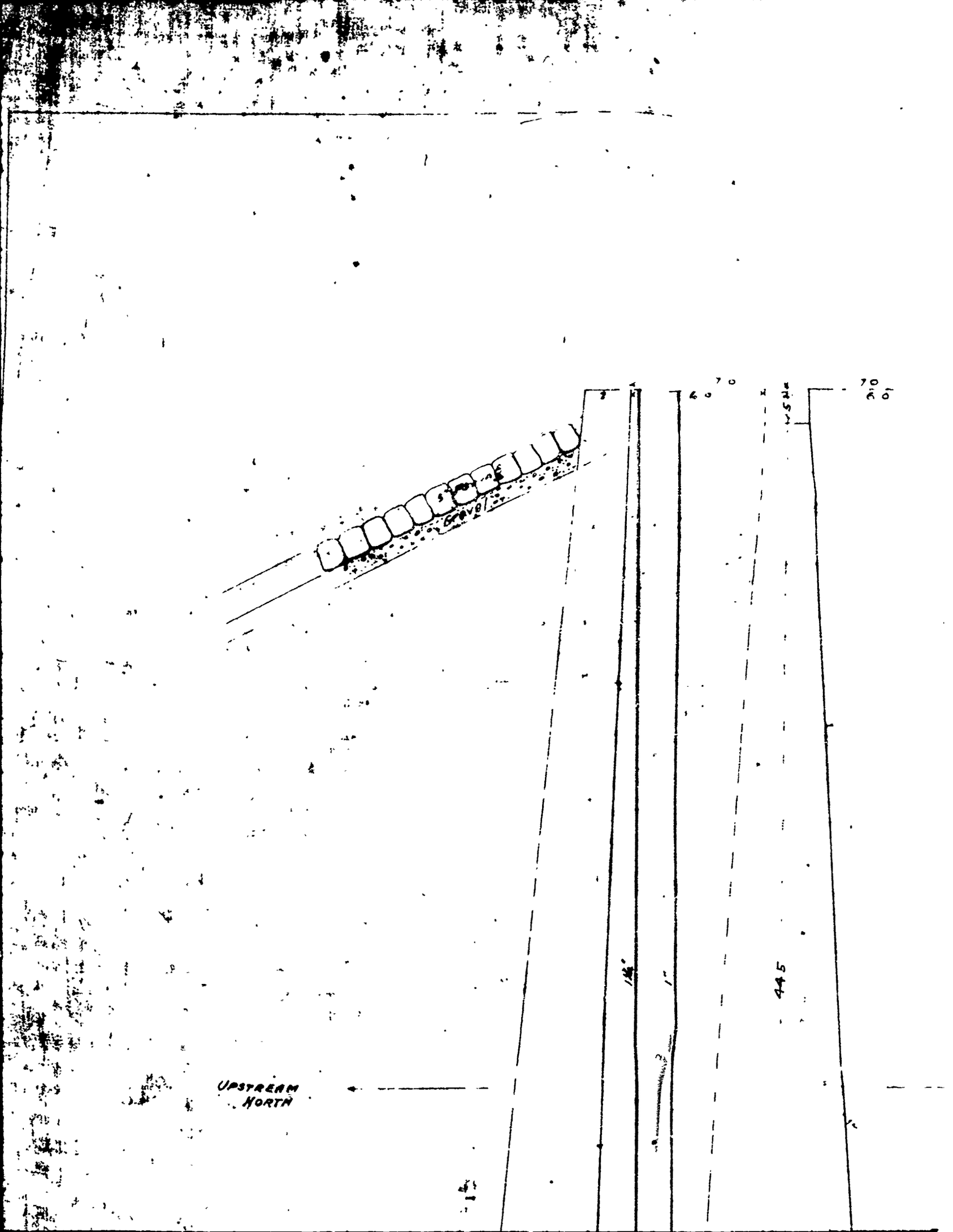
3

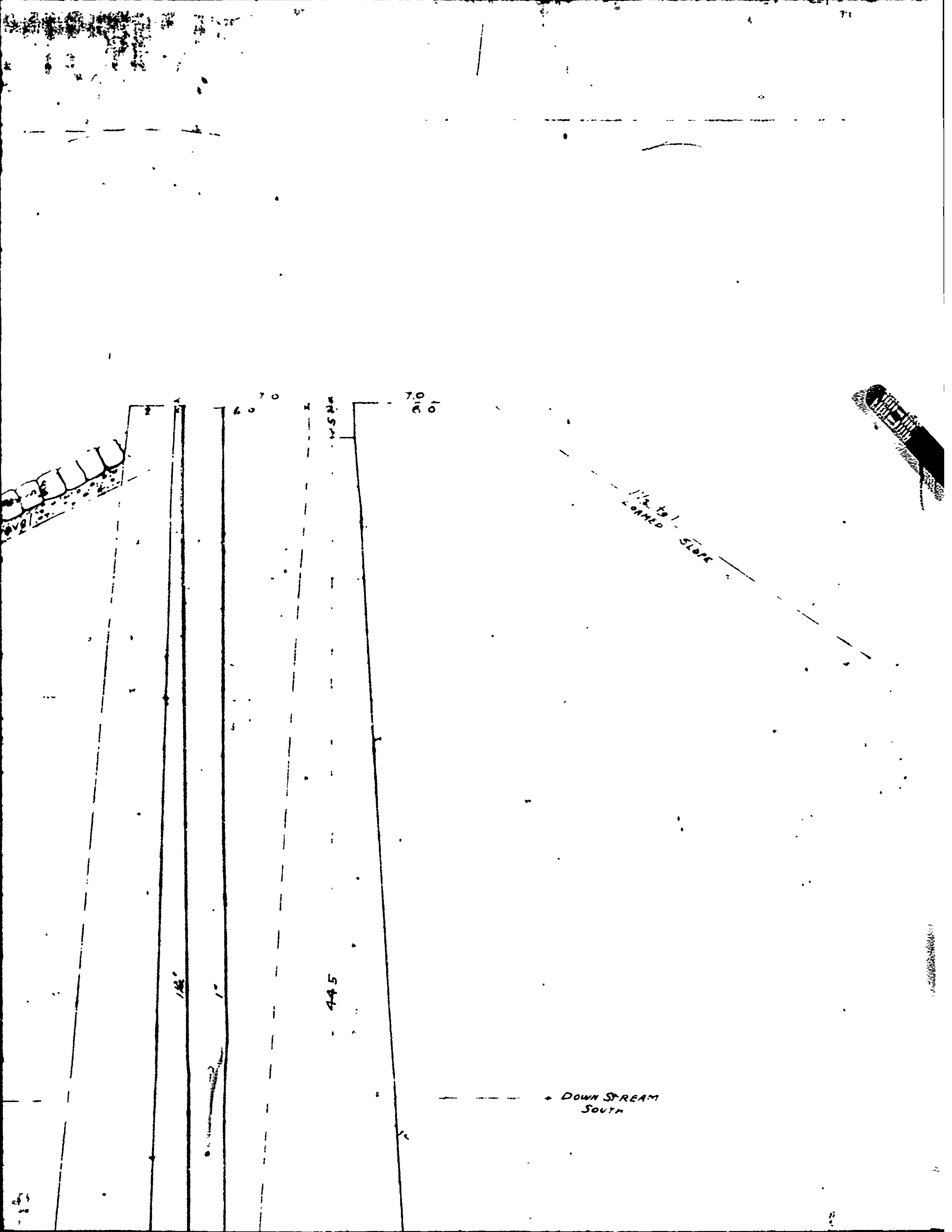
CHAMBER UP TO 414 ELE WITH THE EXCEPTION THAT THE NORTH OR INSIDE WALL AND THE TWO SIDE W

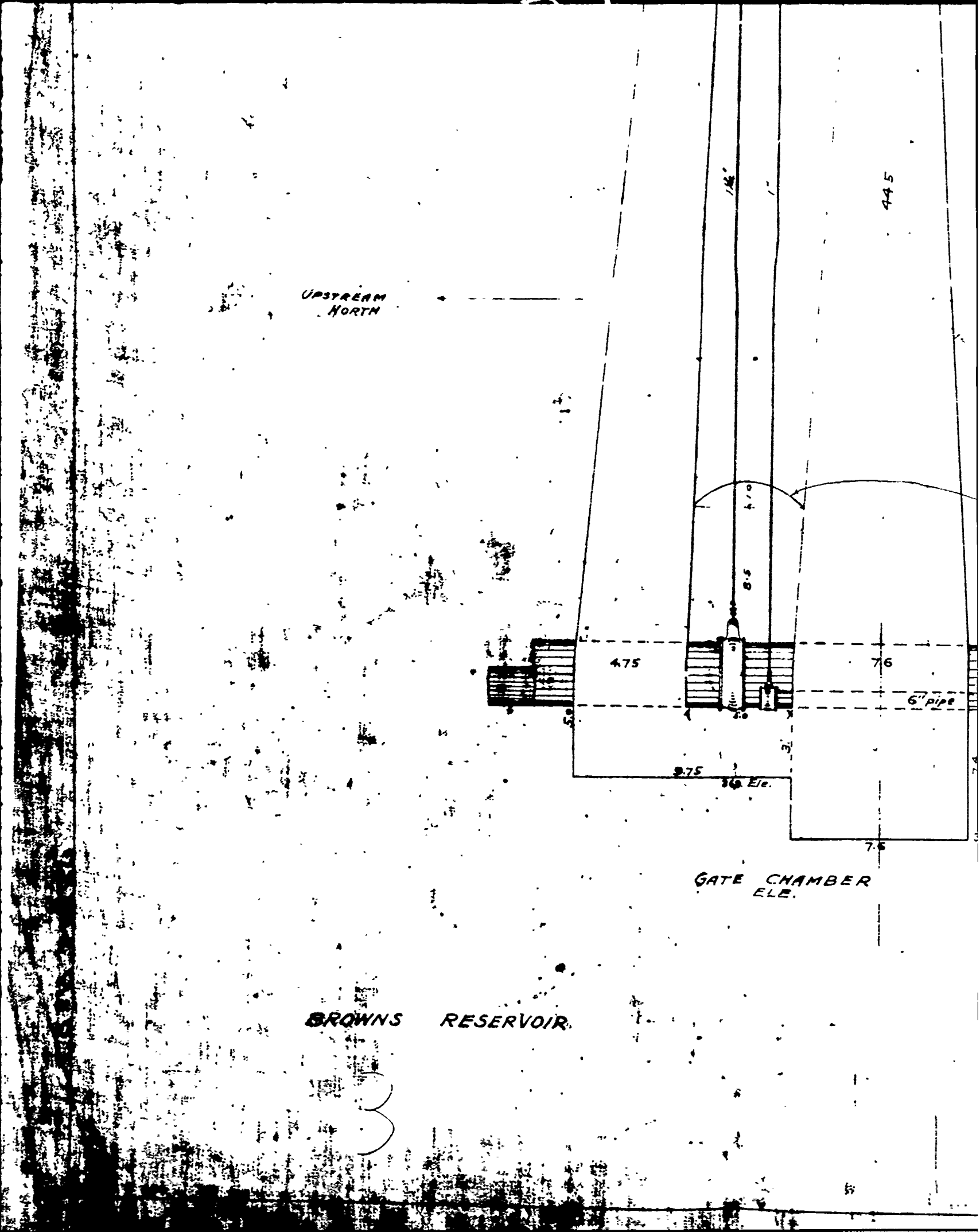
UMB. UPON THE INSIDE OF THE WELL . MAKING MORE ROOM AT THE TOP .

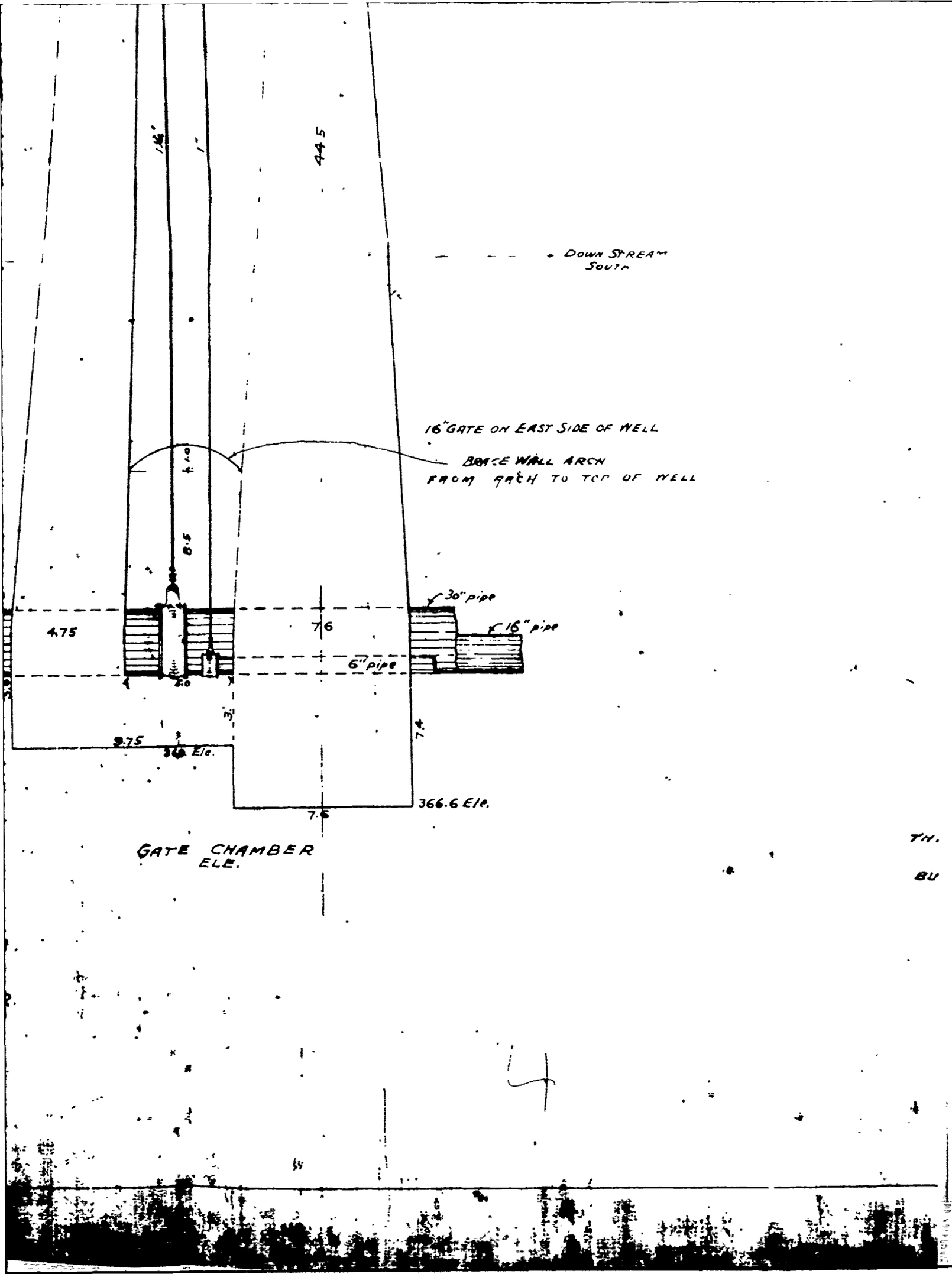


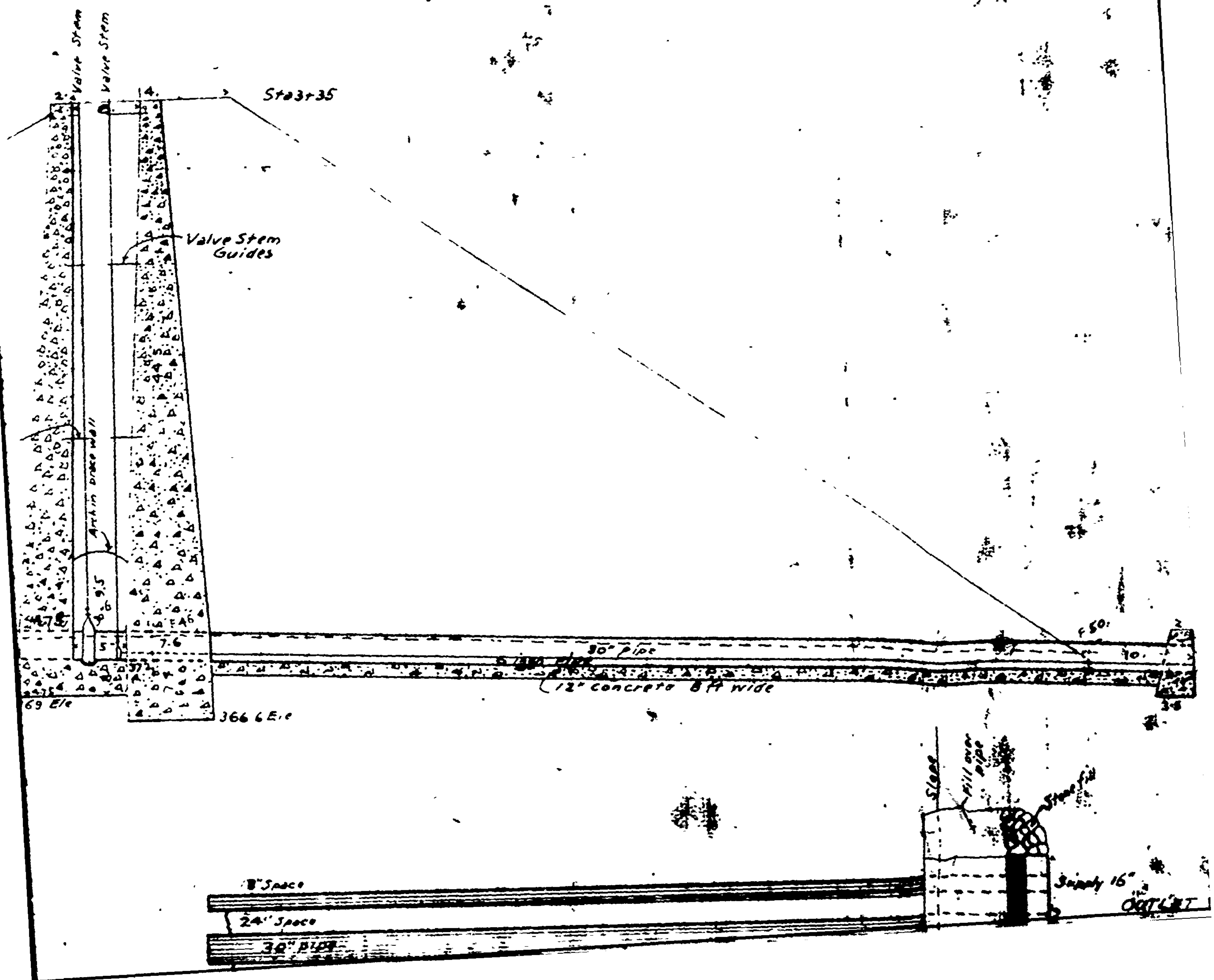
AND THE TWO SIDE


Gravel
UPSTREAM
NORTH
445

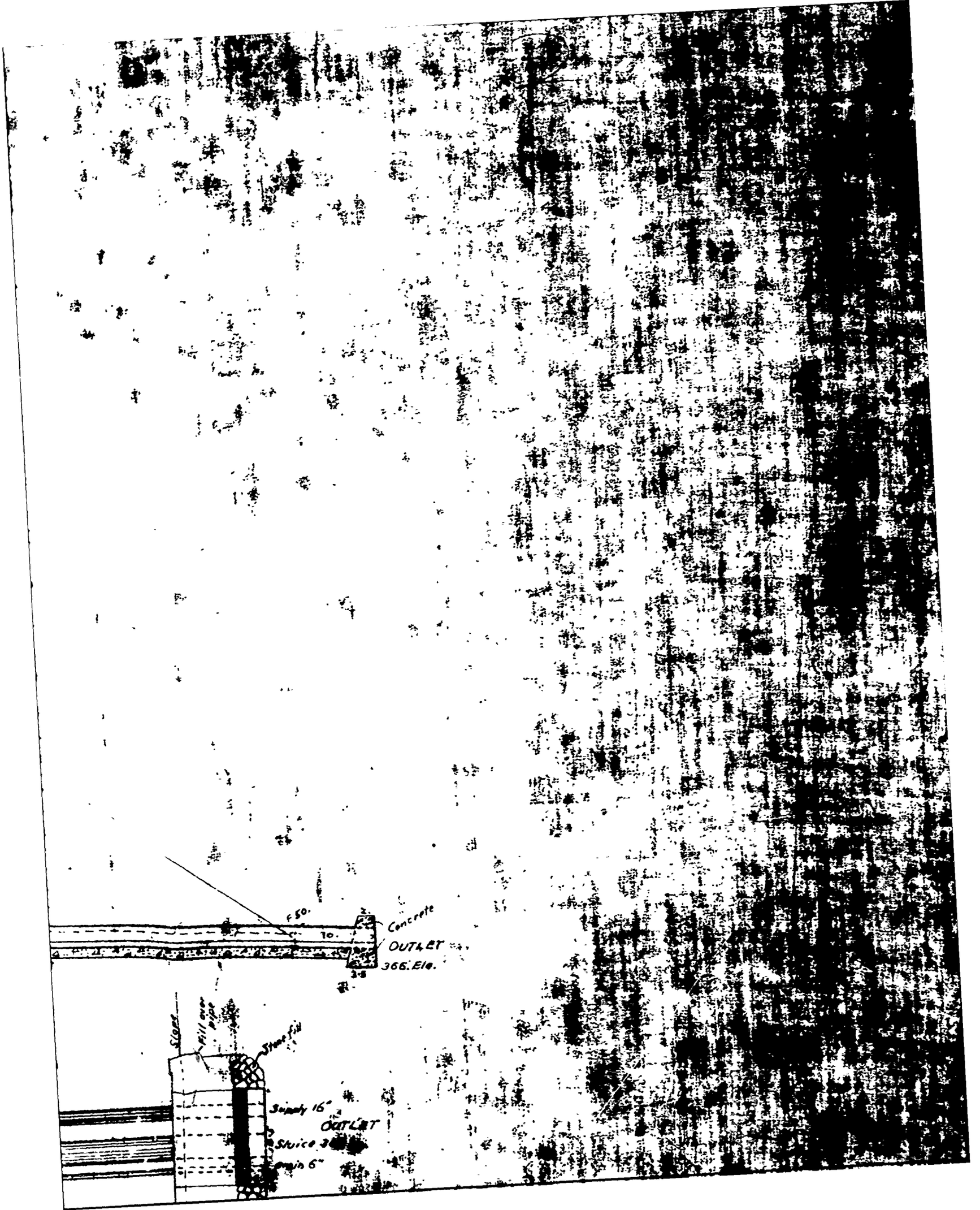

7.0
6.0
7.0
6.0
1½ to 1
SLOPE
445
DOWN STREAM
SOUTH

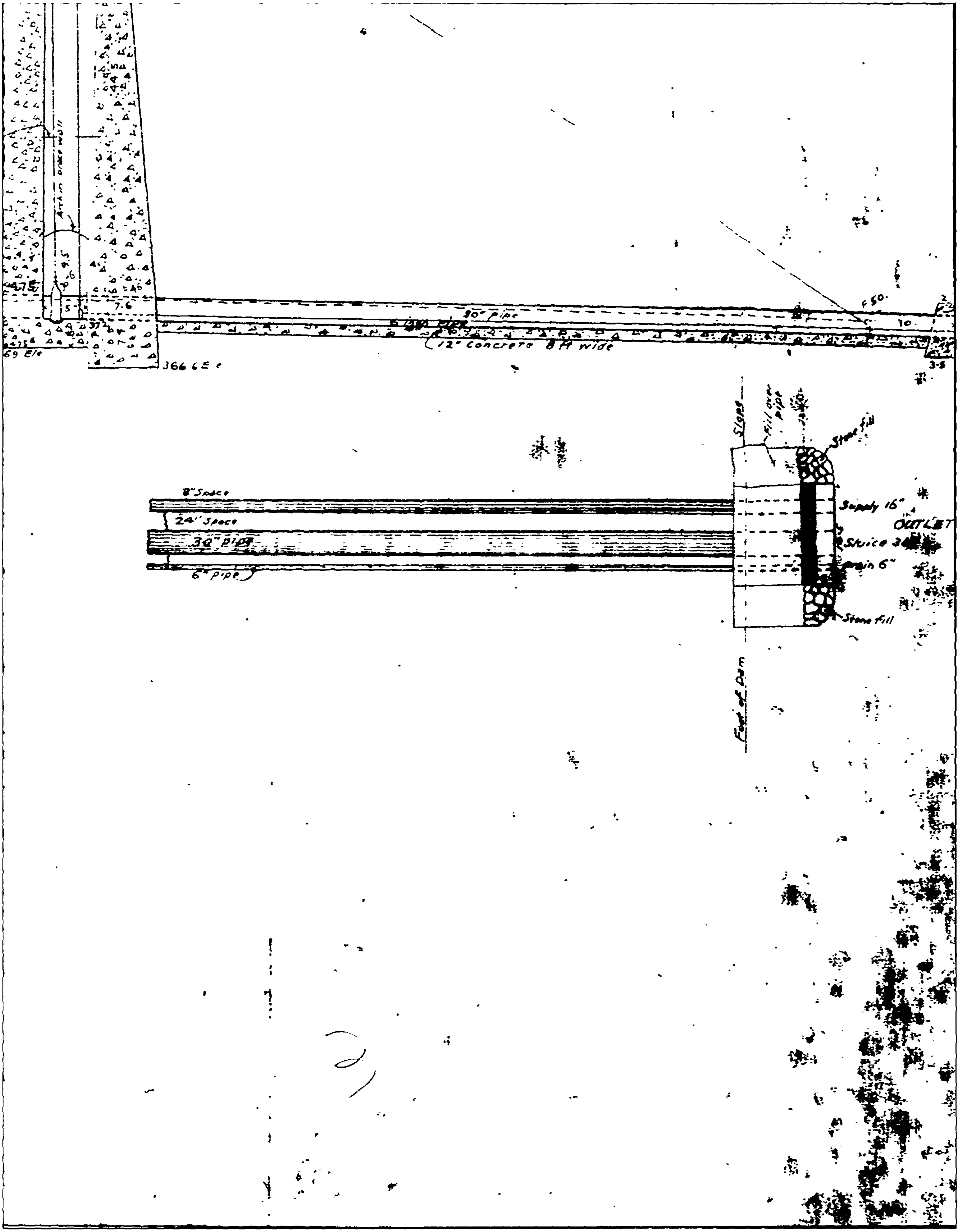

UPSTREAM
NORTH
14'
1'
44.5
4.0
8.5
4.75
7.6
6" pipe
5.0
3'
9.75
Ele.
7.6
GATE CHAMBER
ELE.
BROWNS RESERVOIR.


445
DOWN STREAM
SOUTH
16" GATE ON EAST SIDE OF WELL
BRACE WALL ARCH
FROM PATH TO TOP OF WELL
8.5
30" pipe
16" pipe
6" pipe
4.75
7.6
3.0
3'
9.75
7.4
366.6 Ele.
7.6
GATE CHAMBER
ELE.
TH.
BU

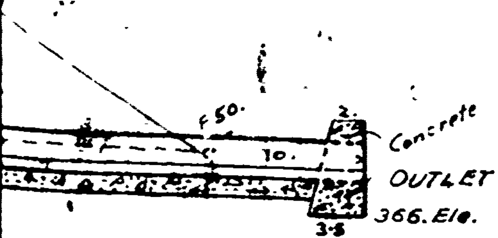


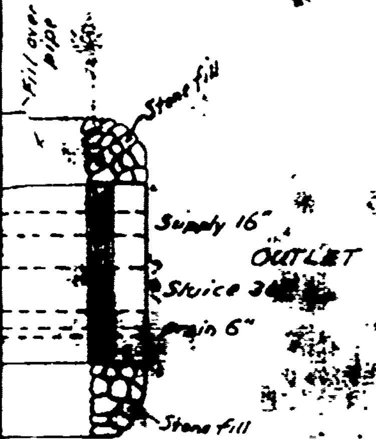
Valve Stem
Valve Stem
Sta 3+35
Valve Stem Guides
30" pipe
12" Concrete 8 ft wide
69 Ele
366.6 Ele
Slope
Stone fill
8" Space
24" Space
30" pipe
Supply 16"
OUTLET


F 50'
To
Concrete
OUTLET
366. Elo.
Slope
Fill over pipe
Stone fill
Supply 16"
OUTLET
Sluice 3
Drain 6"



30" Pipe
12" Concrete 8 ft wide
8" Space
24" Space
30" Pipe
6" Pipe
Slope
Fill over pipe
Stone fill
Supply 16"
OUTLET
Sluice 30"
Drain 6"
Stone fill
Foot of Dam


F 50.
10.
2.
Concrete
OUTLET
366. Ele.
3·5


Fill over pipe
Stone fill
Supply 16"
OUTLET
Sluice
Stone fill

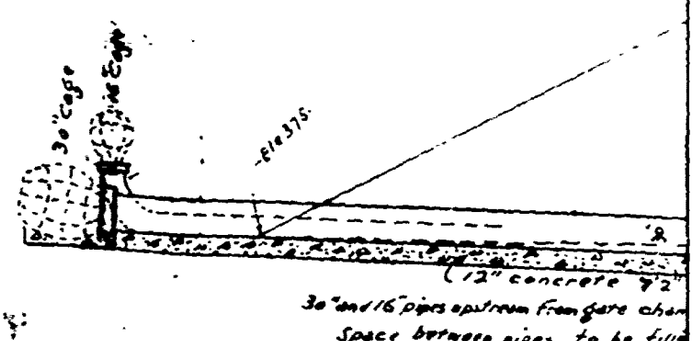
SHEET Nº SEVEN

GATE CHAMBER AND PIPE PLAN

SCALE ONE INCH = TEN FEET

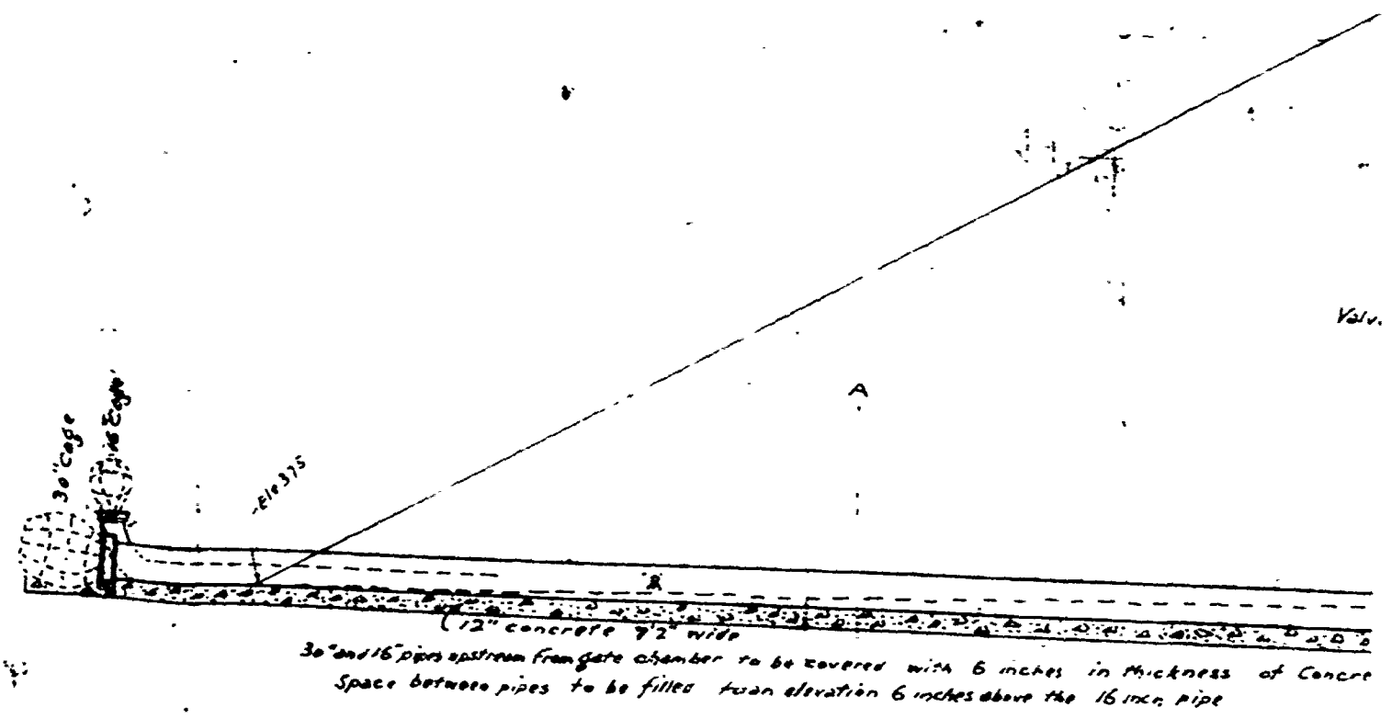
C.N. WOOD, C.E.

1909.



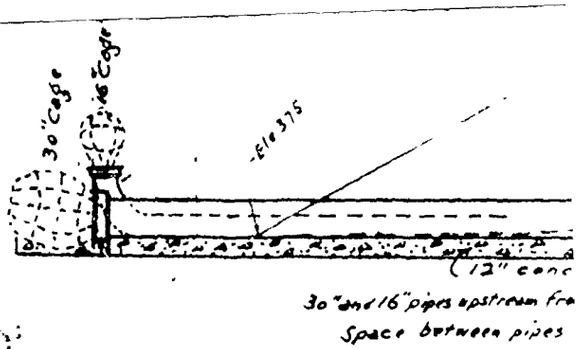
30" and 16" pipes upstream from gate cham

Space between pipes to be fille

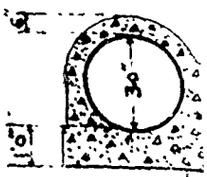


30" and 16" pipes upstream from gate chamber to be covered with 6 inches in thickness of Concre
Space between pipes to be filled from elevation 6 inches above the 16 inch pipe

B



30" and 16" pipes upstream fro
Space between pipes



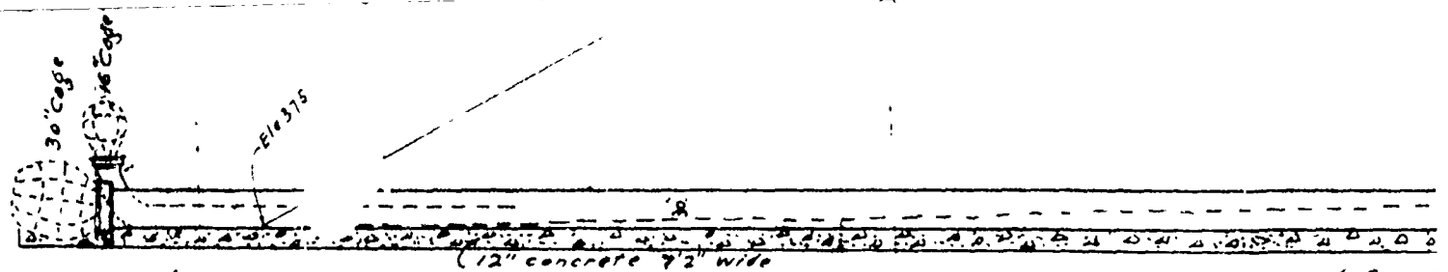
SECTIO
SCALE 1"

SHEET NO 7

BROWN'S RESERVOIR

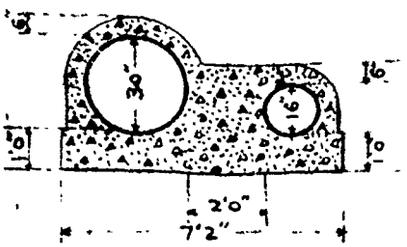
3

A



30" and 16" pipes upstream from gate chamber to be covered with 6 inches in thickness of Concre
Space between pipes to be filled to an elevation 6 inches above the 16 inch pipe

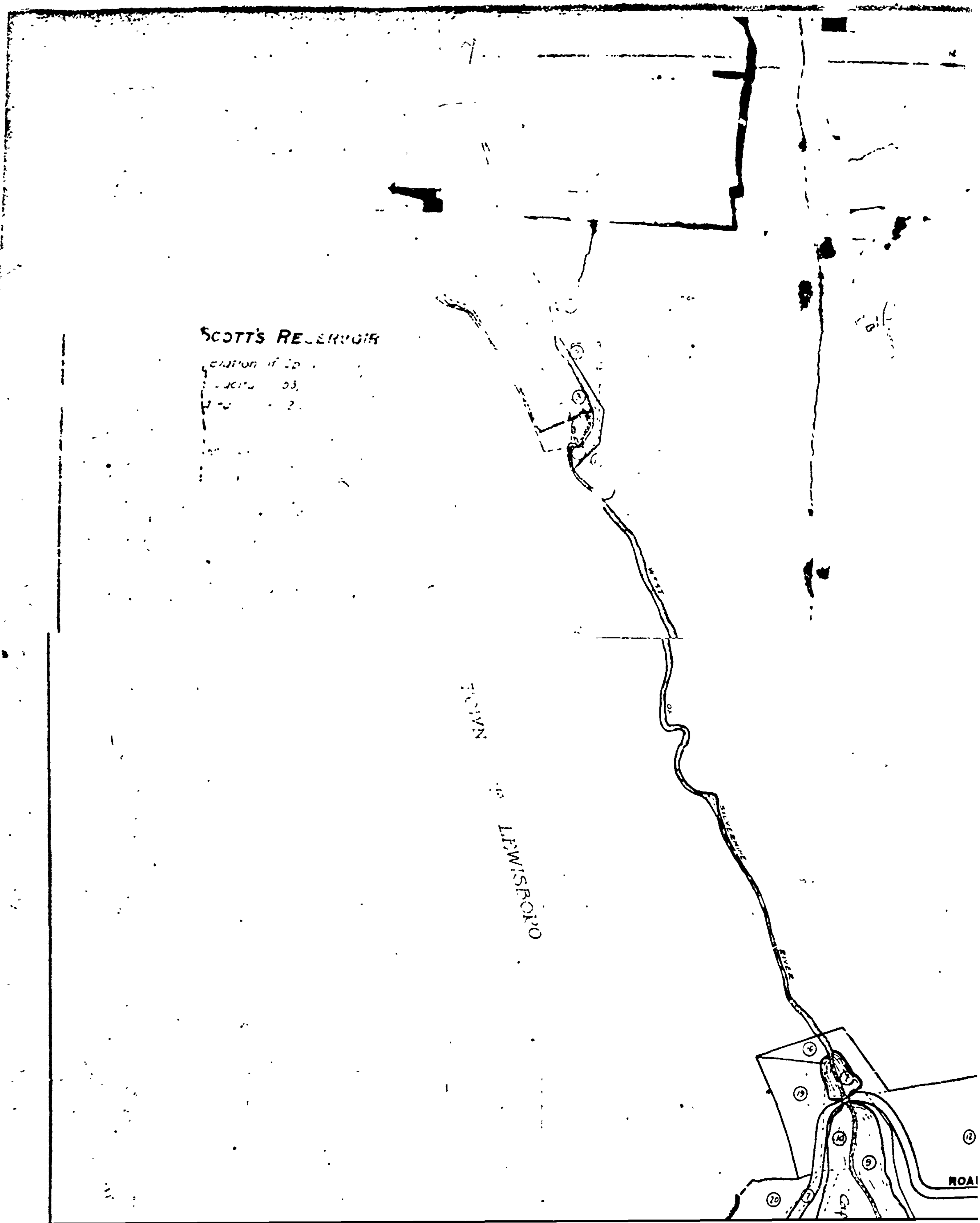
B

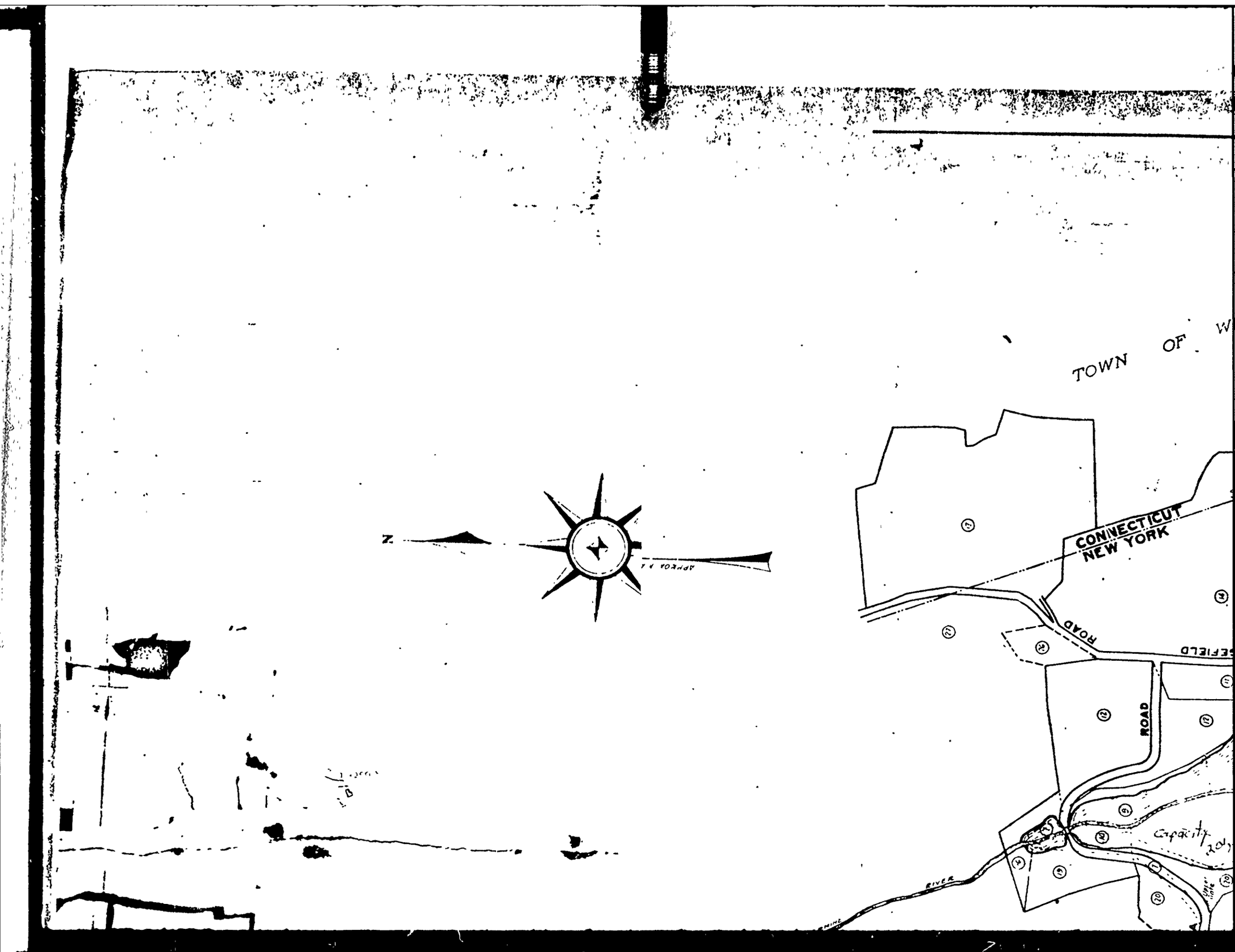


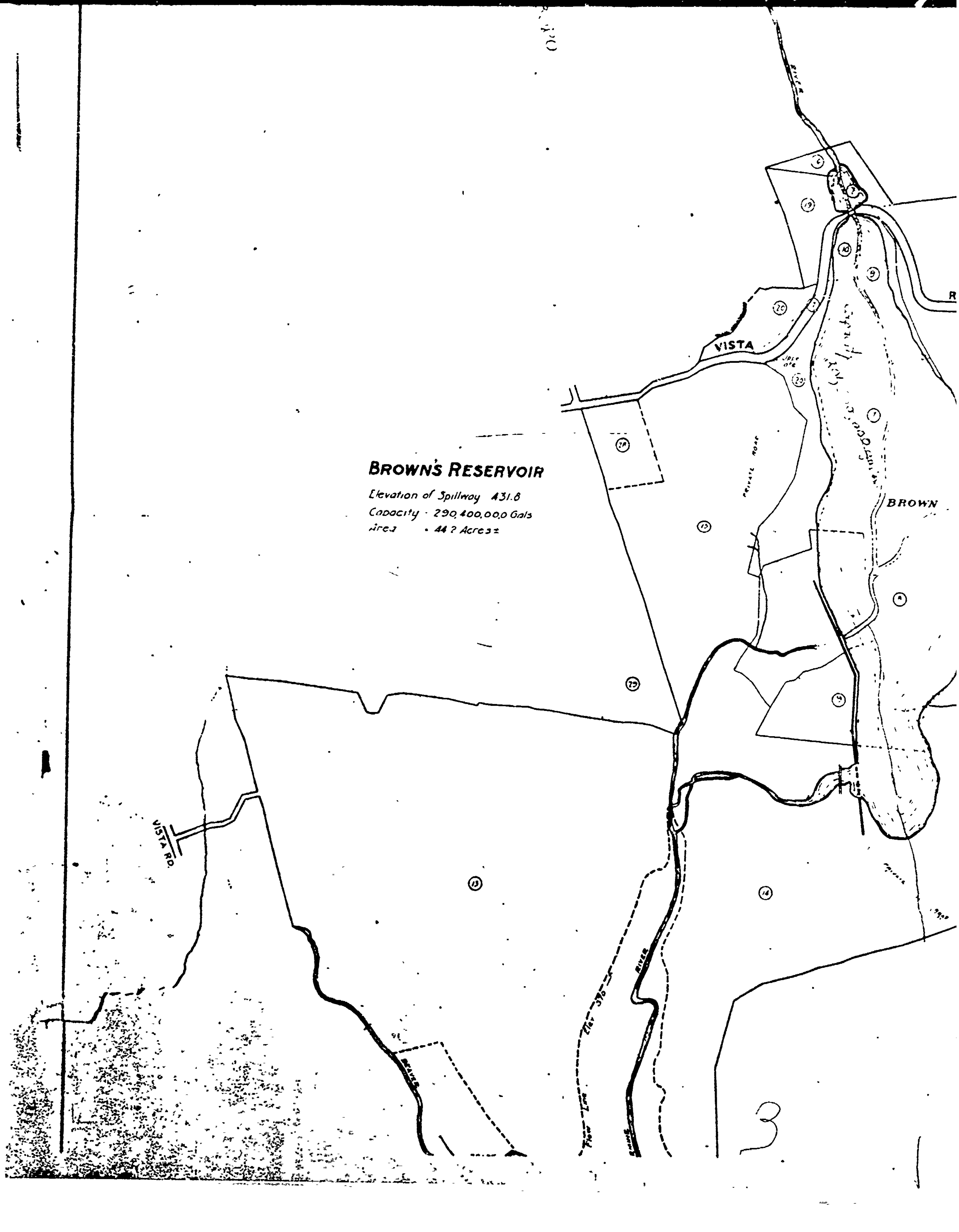
SECTION A-B
SCALE 1" = 4'

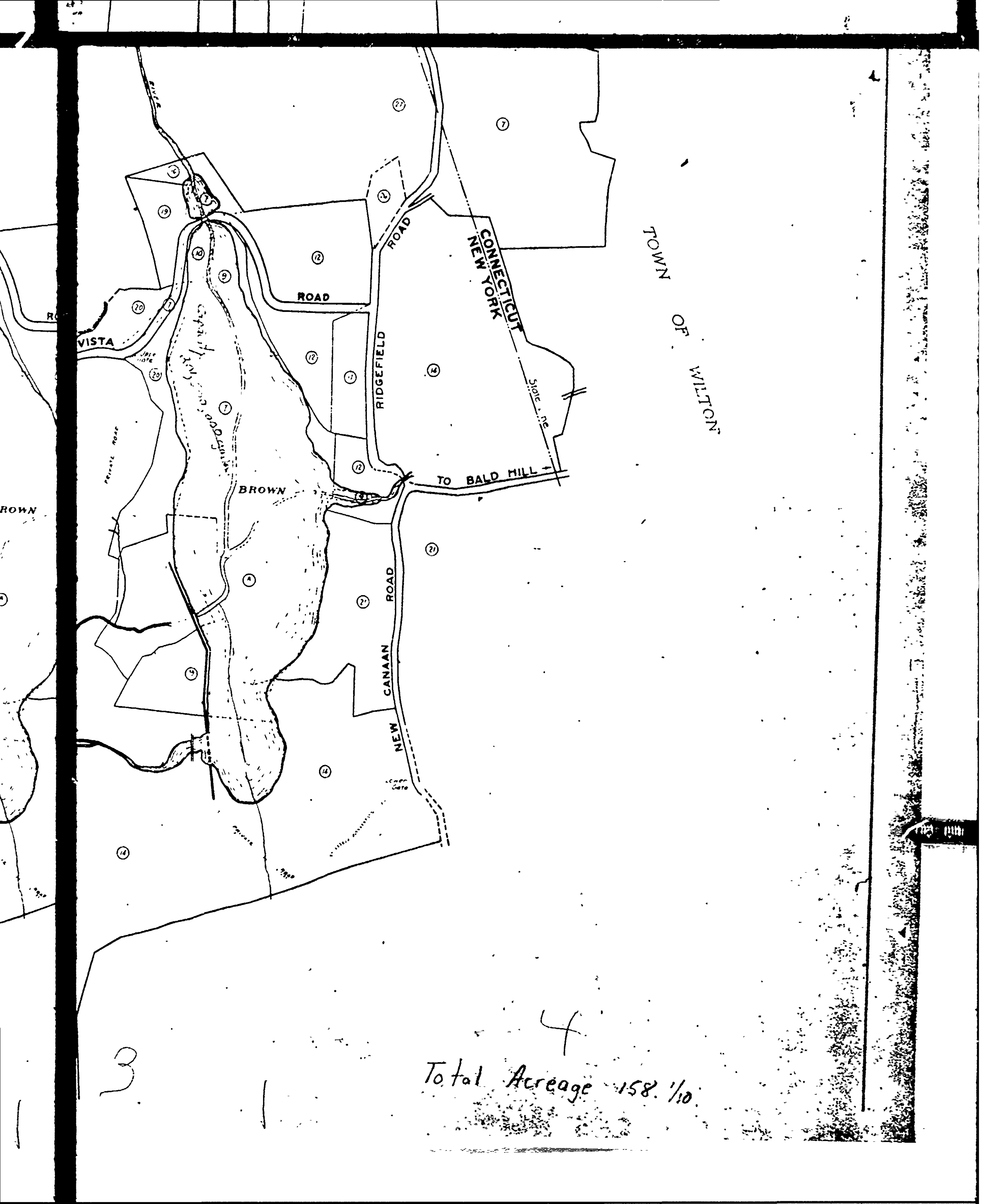
VOIR

4


SCOTT'S
TOWN
LEWISBORO
WEST
SILVERMINE
RIVER


TOWN OF
CONNECTICUT
NEW YORK
ROAD
ROAD
RIVER


BROWN'S RESERVOIR
Elevation of Spillway 431.8
VISTA
VISTA RD.
BROWN
RIVER
3


RIVER
ROAD
RIDGEFIELD
ROAD
CONNECTICUT
NEW YORK
State line
TOWN OF WILTON
VISTA
BROWN
Private Road
TO BALD HILL
NEW CANAAN ROAD
4
3
1
Total Acreage 158 1/10